SPATIAL AND TEMPORAL VARIATIONS IN PHYTOPLANKTON AND ASSOCIATED ENVIRONMENTAL FACTORS IN THE GRAND RIVER OUTLET AND ADJACENT WATERS OF LAKE MICHIGAN

Volume I

by
Elżbieta Ewa Kopczyńska

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Oceanography)
in The University of Michigan
1973

Doctoral Committee:

Professor John C. Ayers, Chairman
Professor Francis C. Evans
Professor Jack L. Hough
Doctor Eugene F. Stoermer, Great Lakes Research Division,
The University of Michigan

Mojej Matce

ACKNOWLEDGEMENTS

I should like to thank the many people who gave advice and assistance during the entire period of this work. I am enormously grateful and indebted to Professor John C. Ayers for his support, guidance and many hours of patient help. To Dr. Eugene F. Stoermer, I am indebted for generous assistance in identification of the algae. To him and to Professor Francis C. Evans I am most grateful for critical reading of the manuscript and constructive comments.

I thank Professor Jack L. Hough for helpful comments and advice, Dr. Claire L. Schelske for reading parts of the manuscript and Dr. Milagros A. Santiago for the numerous discussions concerning the chemical data.

I am deeply indebted to the Great Lakes Research Division of the University of Michigan for providing research facilities and to all the people of the research vessels, the R/V MYSIS and the R/V INLAND SEAS for their help during the field work on Lake Michigan.

The Statistical Research Laboratory of the University of Michigan kindly helped in the analysis of the data.

I am very grateful to Mrs. Wanita Rasey for her care in the typing of the manuscript.

Finally, I am grateful to Roger Tarazi for his encouragement when there seemed no end in view.

TABLE OF CONTENTS

VOLUME I

	Page
ACKNOWLEDGEMENTS	iii
LIST OF ILLUSTRATIONS	vi
LIST OF TABLES	vii
I. INTRODUCTION	1
II. THE STUDY AREA--THE GRAND RIVER MOUTH AREA OF LAKE MICHIGAN	6
III. MATERIALS AND METHODS	6
A. Field Work	6
B. Laboratory Work	7
IV. MONTHLY VARIATIONS IN PHYSICAL-CHEMICAL CONDITIONS AND IN PHYTOPLANKTON COMPOSITIONS	10
A. September 1968	10
B. October 1968	17
C. November 1968	27
D. March 1969	36
E. April 1969	47
F. May 1969	59
G. June 1969	74
H. July 1969	86
I. August 1969	99
J. General Summary of Monthly Data	120
V. SEASONAL CHANGES IN ABUNDANCE OF TOTAL PHYTOPLANKTON AND TOTAL DIATOMS	124
A. The Grand River	124
1. Phytoplankton Fluctuations	124
2. Correlations with Physical-Chemical Factors	126
3. Comparisons with Other Studies	129
B. The Lake	132
1. Phytoplankton Fluctuations	132
2. Correlations with Physical-Chemical Factors	135
C. The Grand River Plume	142

Page

1. Phytoplankton Fluctuations 142
2. Correlations with Physical-Chemical Factors 145

D. Comparison with Other Studies in Lake Michigan 146

VI. STATISTICAL ANALYSES 155

Description of the Multiple Regression Method Used in the Analysis of Phytoplankton Species or Groups 155

The Use Made of the Statistical Analyses 157

Interpretations 158

A. The River Station (PP) 159

Conclusions for the River Station 163

B. The Middle Plume Stations (MP) 163

Conclusions for the Middle Plume Stations 166

C. The Edge of the Plume Stations (EP) 167

Conclusions for the Edge of the Plume Stations 170

D. The Lake Stations, Inshore Area (LAKE) 171

Conclusions for the Lake Stations 174

E. Additional Statistical Analyses of Several Dominant Diatoms and Major Algal Groups Other than Diatoms 174

Conclusions 179

F. Summary 180

VII. GENERAL CONCLUSIONS 184

VIII. REFERENCES 188

VOLUME II (Appendix) 196-487

LIST OF ILLUSTRATIONS ii

LIST OF TABLES iii

LIST OF ILLUSTRATIONS

Figure		Page
1	Locations of sampling stations and of the visible river plume.	196
2	Surface and bottom phytoplankton counts and concentrations of nutrients. September 1968.	205
3	Surface and bottom phytoplankton counts and concentrations of nutrients. October 1968.	208
4	Average phytoplankton counts and concentrations of nutrients. November 1968.	212
5	Surface and bottom phytoplankton counts and concentrations of nutrients. March 1969.	214
6	Average phytoplankton counts and concentrations of nutrients. April 1969.	217
7	Average phytoplankton counts and concentrations of nutrients. May 1969.	219
8	Average phytoplankton counts and concentrations of nutrients. June 1969.	221
9	Surface and bottom phytoplankton counts and concentrations of nutrients. July 1969.	223
10	Surface, bottom and average phytoplankton counts and concentrations of nutrients. August 1969.	227
11	Phytoplankton, nutrients and physical data, the Grand River, September 1968 to August 1969.	233
12	Phytoplankton, nutrients and physical data, the inshore lake stations, September 1968 to August 1969.	238
13	Phytoplankton, nutrients and physical data, the middle of the river plume, September 1968 to August 1969.	241
14	Phytoplankton, nutrients and physical data, the edge of the river plume, September 1968 to August 1969.	244

LIST OF TABLES

Table		Page
1	Dominant Species and Genera of Diatoms Found in the River and Lake Survey Stations. Estimated Numbers of Cells in 1 ml of Sample.	247
2	Relative Abundance of Diatoms in Total Phytoplankton.	257
3	Estimated Numbers of Greens, Bluegreens, Chrysophyta, Pyrrophyta and Flagellates. Units in 1 ml of Sample.	383
4	Phytoplankton, Numbers of Identified Taxa.	437
5	Physical Data and Average Chemical Results.	446
6	Individual Chemical Values and Temperature Measurements.	455
7	Physical and Chemical Results; Averages and Ranges in the Four Areas of Studies, Mouth of the Grand River, the River Discharge and Adjacent Waters of Lake Michigan, September 1968 to August 1969.	479
8	Dominant Diatoms and Major Algal Groups: Estimated Numbers of Units in 1 ml of Sample; Averages and Ranges, September 1968 to August 1969.	480
9	Coefficients of Selected Regression Equations.	483

I. INTRODUCTION

Although many investigations have been published on the ecology of the phytoplankton in lakes, and many but relatively fewer on the phytoplankton in rivers, there seems to be little information on the algal flora in regions where a river enters a large lake. The river mouth-inshore area of a lake is interesting for a biological study particularly in view of our present concern about the man-induced, accelerated eutrophication of waters. Rivers flowing through heavily populated regions, and areas of intensive agriculture or industry, contain high concentrations of plant nutrients. They often contain also various other chemical compounds which either may be harmful for the aquatic organisms or which at best favor the development of undesirable, "weed" species. Rivers discharging into large oligotrophic lakes may modify considerably the chemical character of the adjacent inshore lake waters. The relatively shallow river mouth-inshore lake areas are also subjected to more rapid changes of temperature compared with the large water masses of the open lakes. Strong wind and current action may bring about uniform distribution of nutrients providing an ideal environment for phytoplankton growth. One may expect, then, that the specific physico-chemical conditions of such areas have a pronounced effect on the types and quantity of the phytoplankton as well as on their spatial and temporal distribution.

In recent years it has been apparent that Lake Michigan and the other Great Lakes, particularly Lake Erie and Lake Ontario, are becoming increasingly eutrophied. Chemical changes, and changes in the species composition of the bottom fauna and ichthyofauna, have been accompanied by significant quantitative and qualitative changes in the phytoplankton. Damann (1960) has documented the increase in standing crops of phytoplankton in Lake Michigan near Chicago over the period from 1926 to 1958. Similarly, long term increases in the quantities of the plankton flora have been demonstrated for Lake Erie (Davis, 1964, 1965) and Lake Ontario (Schenk and Thompson, 1965). Considerable qualitative

changes in the photoplankton of Lake Michigan were documented by Stoermer (1967), Stoermer and Yang (1969, 1970) and Holland (1969). Even more drastic long term alterations in the species composition of algae were found in Lake Erie (Hohn, 1969). According to Stoermer and Yang (1970) qualitative changes in the diatom flora of Lake Michigan are especially evident in the inshore areas and bays. The relative abundance of oligotrophic species has decreased, and diatoms favored by eutrophic conditions are becoming increasingly abundant both in the numbers of species and in quantities. Many new species characteristic of polluted areas elsewhere have been introduced into the Lake--they are most abundant in harbors, but appear as well in the plankton of the open waters. It is known also that the inshore areas of Lake Michigan are frequently the scene of high algal blooms (Stoermer, 1968).

Algal blooms are also common in rivers. High numbers of phytoplankton in various rivers of North America were reported by Williams and Scott (1962), Palmer (1964) and Martin and Weinberger (1966). In fact, according to Palmer (1964), comparison of phytoplankton counts from various rivers in the United States with those from several American lakes--including the Great Lakes--showed that during the period 1957-1960 the percentage of algal counts above 1000 cells/ml was much higher for the rivers than for the lakes. Large quantities of planktonic algae with maxima on the order of 40000 to 67000 cells/ml were observed also in several European rivers (Swale, 1964 and 1969; Lack, 1971).

A few investigations of the Great Lakes flora included the outlets of entering rivers. Common to these studies were the observations of high quantities of phytoplankton in the inshore lake waters adjacent to the mouths of tributaries. This has been found in Lake Michigan at the outlet of the Grand River (Stoermer, 1968), in the western end of Lake Erie close to the mouth of the Detroit River (Vaughan and Harlow, 1965, Wujek, 1967; Michalski, 1968) and in the Lake Ontario's Bay of Quinte, in the vicinity of the Trent Canal (McCombie, 1967). The inshore lake waters were found to support higher quantities of algae than the river mouths; this might have been a coincidence,

but quite likely it was due to the type of area or to the season chosen for the studies. [For example, the Detroit River which receives waters from the oligotrophic Lake Huron is known to have relatively small algal populations (Michigan Water Resources Commission, 1970), the Bay of Quinte resembles a large river, and during the winter-early spring season one may expect little phytoplankton growth in most rivers (Hynes, 1970)]. The floras of the river mouths and the adjacent lake waters were dominated by phytoplankters typical of eutrophic conditions. However, the principal species in these two environments were not always the same (Stoermer, 1968; Michalski, 1968). This suggests that different environmental factors played an important role in influencing the phytoplankton populations in the river and in the lake. Both the abundant growth of phytoplankton in those areas and the predominance of algae favored by eutrophic conditions were attributed to the nutrient enrichment caused by the inflow of rivers. Apparently, however, the responses of phytoplankton to nutrient enrichment may be only in the form of increased productivity, and not necessarily in the form of qualitative changes (Parsons, Stephens and Takahashi, 1972; Stoermer, Schelske, Santiago and Feldt, 1972). As observed by Stoermer et al. (1972), who studied phytoplankton in the Grand Traverse Bay, the phytoplankton assemblages there were very similar qualitatively in various parts of the bay receiving different nutrient loadings; they were characterized by diatoms typical of oligotrophic and eurytopic conditions with small relative abundance of forms tolerant of pollution. However, highest standing crops of algae and highest rates of primary productivity were found in the vicinity of the Boardman River, which drains agricultural areas. The authors speculated that significant alterations in the species compositions of phytoplankton may be related to changes in conservative element balance, or to other factors associated with chemical pollution, and it is likely that phytoplankton assemblages "are able to accommodate nutrient enrichment without significant qualitative change up to some threshold value." Only when this

threshold value has been exceeded may considerable changes in the species composition occur. As an example, they point out the results of another study (in Lake Michigan, in the vicinity of the Grand River--Schelske and Stoermer, 1971) in which it was shown that sufficient inputs of phosphorus may cause depletion of silica, with a resultant elimination of diatoms in favor of other algae which do not require silica.

The influence of physical factors on abundant phytoplankton growth in lake areas adjacent to the river mouths has been also considered. The development of a thermal bar during the spring warming in April of 1967 (Noble and Anderson, 1968) at the time of Stoermer's sampling (1968) provided most likely a temporary nutrient "trap" in the inshore waters of Lake Michigan, thus creating favorable conditions for algal growth. Vaughan and Harlow (1965) and McCombie (1967) observed that the rich development of algae in the western end of Lake Erie and in the Bay of Quinte was due largely to the shallowness of these areas, which, coupled with strong current action, enabled good mixing and uniform distribution of nutrients.

In these studies of the river mouth-inshore lake areas, valuable information was gained about the types of response of phytoplankton to the nutrient enrichment caused by inflowing rivers. A variety of environmental conditions exists in various inshore parts of the Great Lakes receiving different nutrient loadings, and yet relatively little is known about the qualitative and quantitative aspects of the algal flora, about the seasonal variations of phytoplankton and the relations of algae to various environmental factors. Little is known also about the ecology of planktonic algae in rivers entering the Great Lakes.

The Grand River, whose mouth region was chosen as the area of the present study, contains high concentrations of various chemical constituents including phytoplankton nutrients (Ayers, 1970). The results of a limnological survey of the lower river and its plume (Ayers and Rossmann, 1967) suggested that the Grand River might be eutrophied to a higher degree than the adjacent lake. The study reported here was undertaken in order to obtain qualitative and

quantitative information of phytoplankton populations--particularly of the diatoms--in relation to various chemical and physical factors. The purposes were also:

1. to determine, at monthly intervals, the differences between the phytoplankton compositions in the river, in the mixing area of the river with the lake, and in the inshore lake waters,

2. to ascertain the seasonal periodicity of total phytoplankton, diatoms and the dominant diatom species,

3. to obtain information about the autecology of a few major diatom species, and

4. to single out the more significant environmental factors influencing numerical abundances of the phytoplankton in the study areas.

II. THE STUDY AREA--THE GRAND RIVER MOUTH AREA OF LAKE MICHIGAN

Figures 1a through 1i show the positions of the sampling stations. A permanent river station (subsequently called "PP") was located in the Grand River beside the Grand Haven Municipal Power Plant, about 2 km upstream from the outlet of the river into Lake Michigan (Fig. 1d). Stations varying in location with river plume position were situated in the center of the river plume (later called "middle of the plume" and "MP") and at the edge of the river plume (called "edge of the plume" and "EP"). These stations were chosen according to the location of the colored water plume of the river and with consideration of the wind at the sampling time and on the preceding days. Stations in the inshore lake water (called "LAKE") were chosen in the direction of the river plume, but well lakeward of the colored river plume. A permanent river station opposite the U. S. Corps of Engineers dock in the lower river was used for chemical analysis to check whether there was inflow of lake water on the sampling day. None was found.

III. MATERIALS AND METHODS

A. Field Work

All of the field work was conducted in the fall of 1968 (September, October, November) and in the spring and summer of 1969 (March, April, May, June, July and August). Samples were collected monthly from three University of Michigan research vessels: the R/V MYSIS, the R/V INLAND SEAS, and in March of 1969 from a University 19-foot outboard motor cruiser.

Physical measurements at the sampling stations included: surface water temperature and vertical temperature profile in the water column by bathythermograph, light intensity measurements at 1 m intervals made with the Submarine Photometer No. 268 WA 300, turbidity by the Hellige

Turbidometer, Secchi disc transparency and water color estimated over the 20 centimeter white Secchi disc. Additional physical data such as wind direction and velocity, wave height estimates and weather conditions were also recorded.

Sampling depths in well-mixed water were at 1 m below the surface and at 0.6 m above the bottom; during the summer stratified period samples were also taken above the thermocline, in the middle of the thermocline, and below the thermocline.

Phytoplankton samples were taken by Nansen bottle. The 1-liter samples were immediately fixed for preservation with an I_2-KI-acetate mixture (Stoermer and Kopczynska, 1967).

Field chemistry tests for O_2, CO_2, pH and alkalinity were done with a HACH field kit from Nansen bottle samples. The HACH methods (HACH DR-EL, methods manual, 6th edition) employ both colorimetric and titrimetric procedures. A modified Azide-Winkler method was used for the dissolved oxygen analysis. Titrimetric methods were used for the determination of total alkalinity and carbon dioxide, pH was determined colorimetrically with a Wide Range Indicator using a 4084 color filter.

Water samples were prepared for later chemical analyses by filtration through 0.8 millipore filters, freezing and subsequent storage in a refrigerator.

B. Laboratory Work

1. Chemical Analyses

After thawing in the laboratory the filtered water samples were analyzed immediately for reactive orthophosphate phosphorus according to the combined method of Murphy and Riley (1962) and Stephens (1963) as described in Schelske and Callender (1970). Analyses for nitrate nitrogen, nitrite nitrogen, silica, chloride and sulfate were by the HACH kit. A Cadmium Reduction Method (Modified Diazotization [1-Naphthylamine-Sulfanilic Acid] Method) was used to determine both nitrate and nitrite nitrogen. Nitrite nitrogen was obtained by a

Diazotization Method. Nitrate nitrogen value was determined by subtracting the nitrite nitrogen value from the first nitrogen test. Silicon as SiO_2 [1] was determined colorimetrically by a Heteropoly Blue Method, chloride was found titrimetrically by a Mercuric Nitrate Method and sulfate was obtained by a Turbidimetric Method.

2. Phytoplankton Analyses

In the laboratory the preserved phytoplankton collections were concentrated to 100 ml in graduated cylinders and stored in amber glass bottles. Subsequently each sample was allowed to settle for 24 hours in a 20-ml Ultermöhl-type chamber and was examined with a Zeiss inverted microscope at 800X magnification. The algae were identified and counted along four transects marked across the settling chamber. The counts were converted into numbers of units in 1 ml of water. Solitary cells of diatoms, flagellates, Chrysophyta and Pyrrophyta were considered as a unit. This was also the case with certain species of the green algae such as those of the genera Ankistrodesmus, Tetraëdron or Lagerheimia; in most cases, however, solitary colonies of the greens as well as colonies or filaments of all the blue greens were treated as a unit.

Because of high amounts of detritus present in the samples, many diatoms and especially the small centrics could not be identified to species under the inverted microscope. For this reason 40 ml subsamples of phytoplankton were cleaned chemically according to the method of Patrick and Reimer (1966) and permanent slides of diatoms were prepared for an exact species identification. The slides were thoroughly examined under oil immersion on the Leitz microscope at 1250X magnification; in cases of high density at least 20 "rows" were considered. The diatom species present were marked as very common, common or rare, the centrics were counted (500 cells per slide), the percent composition of the constituent centric diatom species was calculated and related to the numbers of cells in 1 ml.

---

1. Silicon as silica in crystalline or amorphous form constitutes the major building material of diatom walls (see Lund, 1965).

Over 500 taxa of diatoms and about 200 taxa of other algae were observed in the present study (Tables 1 through 4). Diatoms designated with numbers are those earlier reported from Lake Michigan by Stoermer and Yang (1969); they have not been identified with any known species. A few other taxa--probably new diatom records--are noted also in this study.

In all subsequent discussion, figures and tables referred to are in Volume II, where they may be followed side-by-side with the text.

IV. MONTHLY VARIATIONS IN PHYSICAL-CHEMICAL CONDITIONS AND IN PHYTOPLANKTON COMPOSITIONS

A. September 26, 1968

1. Physical-Chemical Data

On the sampling day, and during several days preceding sampling, the river plume was flowing south. Figure 1a shows the positions of September stations, and Table 5a(1) summarizes the physical data.

The surface water temperature varied from 19.8°C in the river (PP) to 18.9°C at Lake 5. At Lake 1 station, located 1.6 km west from the piers, and not in the direction of the plume, it was 19.7°C.

The Secchi disc transparency increased from 0.7 m at PP to 4.5 m at Lake 1.

The smallest amount (0.82%) of surface light at disc depth (2.5 m) was noted at Lake 5 station, where the water was almost as dirty as in the river and the plume area. The maximum 27.77 percent corresponded with a Secchi depth of 4.5 m at Lake 1, the only station where the water was clean. Calculations indicated that the waters at station MP contained 46% and at station EP 11% of river water.[1]

Table 5a(2) presents the average chemical results. The maximum values of alkalinity, chloride, sulfate, nutrients and turbidity were observed in the river. The lowest values were found either at Lake 1 station or at EP (e.g., nitrate nitrogen, orthophosphate). The results at Lake 5 were generally slightly higher than either those at EP or Lake 1. The minimum average value of dissolved oxygen (7.5 ppm) was found in the river--it could be attributed to a high amount of decomposing organic matter in the eutrophied river water. Especially noteworthy was the drastic decrease of phosphate from the river (72.25 ppb) to the MP (9.35 ppb), EP (4.05 ppb) and lake stations (ave. 4.36 ppb), while the average concentrations of silica were very similar at each station (slightly above 0.60 ppm at PP, MP, EP and 0.53 ppm at

1. Percent of river water was calculated on the basis of values for chloride and sulfate, by the method of Ayers and Rossmann (1967).

Lake 1). Generally, there were small surface to bottom variations, or uniform vertical distributions of individual values of any of the eleven chemical parameters. The measurements are given in Tables 6a to 6k, (September 1968).

2. Phytoplankton Data

Figures 2a and 2b illustrate the difference in counts of total phytoplankton and major phytoplankton groups between the river, middle plume, edge of the plume and lake stations. The results are expressed as thousands of phytoplankton units in 1 ml of sample. The maximum counts of total phytoplankton were found at the surface of PP and MP stations, 16163 and 10010 units/ml, respectively. The third highest number, 6461 units/ml, was recorded from the bottom sample of MP station. The smallest counts were found at Lake 1 station with the average of 654 units/ml.

Comparison of Figures 2a, 2b with Figs. 2c, 2d and Tables 6e, f,g,h, shows that the total phytoplankton, diatoms and greens maxima as observed in the river and middle plume corresponded generally with the highest orthophosphate and nitrate values found in September, and on the other hand, with silica values very similar to those found at stations where the phytoplankton concentrations were much smaller (EP, Lake 5). The minimum total phytoplankton and diatom counts from Lake 1, especially those from the surface (diatoms - 395 cells/ml) and 10 meters depth (diatoms - 343 cells/ml), corresponded with very low silica values, 0.32 ppm at 1 meter and 0.52 ppm at 10 meters. The phosphate concentrations at this station were minute, about 4 ppb, however similar to those at stations EP and Lake 5 where much higher phytoplankton counts were found compared to these at Lake 1. It seems that the drop of silica content in the water limited diatom populations found at Lake 1. Pearsall (1932) and Lund (1950) suggested that diatoms cannot multiply to any marked extent when silica concentration falls to approximately 0.5 mg/l. Lake 5 total phytoplankton and diatom counts, much higher than at EP and Lake 1, corresponded with average nutrient values higher than at EP and average silica value of 0.62 ppm, higher than at Lake 1.

3. Bacillariophyta

In all September samples, except those from Lake 1, diatoms comprised at least 84 percent of total phytoplankton. At Lake 1 they constituted about 67 percent of the total. The diatom maxima corresponded with the maxima of total phytoplankton. The highest numbers of cells per ml, 14018 and 8960, were recorded from the surface at PP and MP stations. Diatoms, cell counts, and the relative abundance of diatoms in total phytoplankton are presented in Tables 1 and 2 (September data).

At all stations, centric diatoms, and within these just a few dominant species comprised the majority of total diatom populations. Cyclotella meneghiniana v. plana, Melosira granulata v. angustissima and M. granulata occurred in particularly high concentrations, especially in the river, middle plume and at Lake 5. The maximum counts for these species were: for C. meneghiniana v. plana 7970 cells/ml and for M. granulata 1456 cells/ml at the surface in the river, for M. granulata v. angustissima 3378 cells/ml at the surface of the middle plume. Several other species were present in abundance, often above 50 cells/ml, with the concentrations usually sharply decreasing from the river toward the lake. Only at station Lake 5 were the populations higher than those at EP or Lake 1.

Stephanodiscus subtilis and S. tenuis were found in the river in average concentrations of above 200 cells/ml. At the remaining stations their numbers were generally much below 50 cells/ml with one exception when S. subtilis was present at the surface of the middle plume station in large quantities (203 cells/ml).

S. hantzschii, S. alpinus, Cyclotella stelligera and C. ocellata occurred at the surface in the river in numbers of above 50 cells/ml (the count for C. stelligera was 173 cells/ml). At other stations their concentrations were much smaller, and C. ocellata was only present at the MP and Lake 1 stations.

Rather large populations of C. michiganiana were found at each station, with the highest counts of 158 and 148 cells/ml at the surface of Lake 5 and MP. The lowest numbers of this species, with an average of ca. 40 cells/ml occurred at both the river and Lake 1 stations.

Especially noteworthy was the presence of Coscinodiscus subsalsa in almost all samples. This species is characteristic of highly eutrophied waters and recently became one of the dominant phytoplankters in Lake Erie (Hohn, 1969). The highest count of this species, 55 cells/ml, was found at the surface in the river, the lowest, 1 cell/ml, at the bottom of Lake 1.

Altogether, 182 diatom taxa were included in September counts (Table 2 and Table 4a). The highest variety of taxa, 121, was observed in the middle plume samples, the smallest, 66, in samples from Lake 1. The genera Nitzschia, Navicula and family Fragilariaceae were represented by the highest number of species. They are pennate diatoms, which mostly contributed to the total quantities of diatoms. With few exceptions (e.g., Synedra, Tabellaria fenestrata and Asterionella formosa) they were found in largest abundance in the middle plume, with the average concentrations for each group, ca. 100 cells/ml, decreasing toward both the river and lake.

Within the genus Nitzschia, N. palea, and two entities designated as Nitzschia sp #2 and Nitzschia sp "B" were found commonly in the river. N. palea and also N. dissipata were present in almost all September samples, but most of the time in low quantities.

Among species belonging to the genus Navicula, N. latens, N. decussis, N. costulata, N. pupula v. mutata and Navicula sp. "A" were found most commonly, especially in the river plume area (MP, EP) and at Lake 5. Species N. cryptocephala v. intermedia and N. tripunctata were common in the river.

Fragilaria crotonensis occurred in the middle plume in average concentrations above 100 cells/ml. Its average numbers in the river, the plume edge and both lake stations were usually below 50 cells/ml. Other members of the genus as F. construens, F. pinnata and F. intermedia were very common in the middle plume, less common in the river, the edge of the plume and at Lake 5, and practically absent from Lake 1.

Among members of genus Synedra (maximum total count: 82 cells/ml at surface, PP) S. ulna and S. ulna v. chaseana were found in almost

all samples, however S. ulna was present in much higher abundance, mainly in the river and the middle plume. Synedra parasitica v. subconstricta was common or quite common at MP, EP and Lake 5 and S. delicatissima was common in the river.

Tabellaria fenestrata was very common in lake water with the highest counts of 25 and 27 cells/ml at 1 and 10 meters of Lake 1. The numbers decreased toward the river, where only 1 c/ml was noted.

Asterionella formosa was most common at the surface of Lake 5 (26 cells/ml), with the counts decreasing toward the river (2 cells/ml).

In addition to the phytoplankters discussed above, the following species were commonly found: in the river alone - Achnanthes exigua, A. lanceolata and Amphora ovalis v. pediculus.

In both the river and the middle plume Achnanthes lanceolata v. dubia, A. clevei v. rostrata, Cocconeis pediculus and C. placentula v. euglypta were common.

In the middle plume, edge of plume and Lake 5 stations - Amphora neglecta and A. subcostulata were common.

4. Chlorophyta

Green algae made up between 4.88 percent (Lake 1) and 9.34 percent (PP) of total phytoplankton in the September samples. The average numbers in 1 ml (Table 3) as well as the diversity of species (Table 4) decreased from the river toward the lake. The maximum total count recorded at the surface in the river was 1509 cells and colonies in 1 ml. The minimum numbers of units per ml., ave. 43, were found in samples from Lake 1.

Two genera, Scenedesmus and Oocystis, were found in highest abundance and were represented by more species than other genera. Members of genus Scenedesmus, S. abundans, S. quadricauda, and its variety S. quadricauda v. westii, S. dimorphus, S. incrassatulus and S. acutiformis occurred in large quantities in the river and middle plume and were present in almost all samples. Three highest counts recorded were: for S. abundans and S. quadricauda 189 and 152 colonies/ml

at the surface of PP, and for S. dimorphus 68 colonies/ml at the bottom of PP. The lowest numbers of genus Scenedesmus ± 1 col/ml were found at Lake 1.

Quantitatively, the genus Oocystis was mainly represented by O. solitaria and O. borgei, species found in all September samples, and most abundant in the river and the middle plume. O. solitaria occurred in maximum numbers of 130 col/ml at the surface in the river, and O. borgei in numbers of 30 col/ml at the bottom in the river. Counts of these two species at both lake stations varied from 1 - 19 col/ml.

Several other species of different genera occurred in large abundance in the river. They were present in almost all other samples, but their numbers were fewer, definitely decreasing toward the lake, with the minimum and often zero counts observed at Lake 1. Among them Ankistrodesmus falcatus was found in abundance of 183 cells/ml at the surface in the river. The highest counts of Actinastrum hantzschii, Dimorphococcus lunatus, Dictyospherium pulchellum, Coelastrum microporum, and of Pediastrum duplex ranged from 28 to 44 col/ml.

5. Cyanophyta

Among the blue-greens only Phormidium spp., Aphanocapsa spp., and Chroococcus limneticus occurred in relatively high quantities in the September collections. Phormidium spp. were very numerous at the surface in the river, 109 filaments/ml, but absent from the bottom. They were also found very commonly (18 - 35 fil/ml) in the middle plume and at Lake 5. Aphanocapsa spp. were absent from the river, common at MP and EP, and very common at both lake stations, with the highest count of 41 col/ml found at the surface of Lake 5. Chroococcus limneticus occurred most numerously at Lake 1 with a maximum of 21 col/ml at the surface.

6. Chrysophyta

Dinobryon divergens and Dinobryon bavaricum were found in high quantities at the MP, EP and Lake 5 stations, especially at the bottom.

The maximum counts were: for D. divergens 82 cells/ml and for D. bavaricum 39 cells/ml from bottom samples of Lake 5. These two representatives of Chrysophyta were absent from the surface of PP and MP stations and also from the bottom of Lake 1.

7. Pyrrophyta

Several species of the genus Peridinium were found very commonly in practically all collections, with the maximum counts in the river, the middle plume and at Lake 5. The highest number of cells, 41/ml, occurred at the bottom of the MP station.

8. Flagellates

Chlamydomonas sp. and Cryptomonas sp. were present in large abundance in September, although Chlamydomonas was conspicuously absent from the river. The maximum populations of both species were found at the surface, with the exception of station Lake 1 where the highest numbers occurred at the bottom. The two maximum counts of Chlamydomonas, 139 and 137 cells/ml were recorded from the surface of MP and the bottom of Lake 1. The highest count of Cryptomonas, 394 cells/ml, was found at the surface in the river.

Euglena spp. (max. 37 cells/ml) and Pteromonas spp. (max. 36 cells/ml) were very common in the river and middle plume.

B. October 15, 1968

1. Physical-Chemical Data

Figure 1b shows the contours of the river plume on the sampling day, and the location of stations. During several days preceding sampling, the plume was flowing north under the influence of a SSW wind. At the sampling time it was turning NE onto the beach.

Table 5b(1) presents the physical data. The surface water temperature rose from 16°C in the river to 16.9°C at the edge of the plume. At each station the surface temperature readings were only slightly higher (0.1 - 0.5°C) than those at the bottom (Table 6ℓ).

Secchi disc transparencies increased from 0.8 m in the river to 4.7 m in the lake. The amount of surface light at Secchi depth varied from 1.98 percent (MP) to 3.22 percent (PP).

According to calculations the waters at station MP contained 28% of river water, and at station EP -- 13%.

The average chemical results obtained at the October stations are shown in Table 5b(2). With the exception of dissolved oxygen content (max. 7.5 ppm, Lake), there was a general decrease of chemical values from the river toward the lake. The decrease was sharp at first from the river to the middle plume and then more gradual toward the edge of the plume and lake. Particularly interesting were the differences between stations in the results of nutrients and silica (see also Fig. 3c,d). The values of nitrates at the middle plume were about twice as small as those in the river, the silica concentrations decreased by the factor of three and the amounts of orthophosphate by a factor of four. While the further decrease of nitrate and silica from MP to EP and Lake was gradual, the decrease of values of phosphate from the middle plume to the edge of the plume was of the same order as the decrease from station PP to MP. Somewhat higher than at the edge of the plume, average phosphate values from the lake station were caused by relatively high individual surface values.

Generally, the surface and bottom results of individual chemicals (Tables 6a-6k) were very much alike if not identical, only oxygen, and orthophosphate values showed more pronounced variations with depth.

2. Phytoplankton Data

Figures 3a and 3b illustrate the cell counts in 1 ml of total phytoplankton and of major phytoplankton groups as they decrease from the river toward the lake. The average total phytoplankton and diatom concentrations at each station decreased over twice in comparison with every preceding station. (Compare also with Figs. 3c and 3d showing the decrease of average nutrient and silica values.) The surface and bottom phytoplankton abundances within both the MP and Lake stations were of similar sizes, while in the river and edge of the plume the vertical differences in phytoplankton numbers were somewhat more pronounced. The highest total phytoplankton counts recorded were: 17195 and 14720 units/ml, from the surface and bottom in the river. The two smallest counts found at the Lake station were 954 and 1091 units/ml, at the surface and bottom, respectively.

3. Bacillariophyta

Diatoms made up between 64.18 percent and 89.61 percent of total phytoplankton in the October samples. The total counts (Table 1) ranged from 659 cells/ml (at the surface, in the lake) to 15269 cells/ml (at the surface, in the river). As in September, the Centrales, and first of all *Cyclotella meneghiniana* v. *plana*, *Melosira granulata* v. *angustissima* and *M. granulata* comprised either the major portion (at stations PP, MP, EP) or a very high portion (in the lake) of the total diatom and total phytoplankton populations. The maximum counts reported for these three species were respectively: 8628 cells/ml at the bottom in the river, 3465 cells/ml and 1339 cells/ml at the surface in the river. The minimum quantities of these species, strikingly small, as compared with the numbers in the river, were found in the lake; the

average lake populations of M. granulata v. angustissima (81 cells/ml) were higher than those of M. granulata (75 cells/ml) and much higher than those of C. meneghiniana v. plana (36 cells/ml).

The highest numbers of other most abundant centric diatoms as Stephanodiscus subtilis (max. 561 cells/ml), S. tenuis (max. 411 cells/ml), S. astrea (max. 280 cells/ml) and Coscinodiscus subsalsa (max. 94 cells/ml) were found at the surface in the river. Their smallest quantities (1 - 3 cells/ml), except for S. subtilis, were noted at the surface in the lake. Stephanodiscus subtilis was absent from the lake collections, and the minimum numbers, 20 cells/ml, were observed at the surface in the edge of the plume.

Cyclotella stelligera was present in the river with a maximum of 237 cells/ml found at the bottom. The average populations decreased toward the lake, where only 4 cells/ml was noted.

Two species, Cyclotella michiganiana and Stephanodiscus alpinus occurred in very high quantities in the mixing water area (MP, EP). The former species was absent from the river, and the latter was present there only at the surface (40 cells/ml). A maximum of C. michiganiana, 236 cells/ml, was noted at the bottom in the middle plume. Its surface and bottom populations within the EP (ave. 109 cells/ml) and Lake stations (ave. 42 cells/ml) were nearly uniform. The counts of S. alpinus ranged from 5 cells/ml at the bottom in the lake to 121 cells/ml at the bottom in the middle plume.

Several other representatives of the Centrales were found very commonly, either in the plume area (MP, EP) or in the river. Their maximum counts were lower than 45 cells/ml.

Absent from the river and present in highest quantities at the middle plume or edge of the plume were: Cyclotella comta (max. 43 cells/ml at the surface of MP), C. kützingiana (max 27 cells/ml at the surface of both MP and EP stations), and C. ocellata (max 21 cells/ml at the bottom of MP). The lowest numbers (1 - 7 cells/ml) of these three species were noted in the lake.

Melosira varians and *Stephanodiscus hantzschii* were very common in the river, with maximum numbers of 32 and 46 cells/ml, observed at the bottom. The former species was absent from the lake collections, and its quantities at the middle plume and edge of the plume ranged from 4 - 15 cells/ml. The numbers of *S. hantzschii* at MP, EP and Lake were much lower than in the river (3 - 6 cells/ml).

Pennales were found in highest abundance at the middle of the plume (ave. 1232 cells/ml). The minimum quantities (ave. 400 cells/ml) were observed in the lake, however, at the Lake station, the pennate diatoms made up a higher portion (39.31 percent) of the total phytoplankton than the Centrales (26.79 percent). The flora of the pennate diatoms was diverse; among 171 entities included in total diatom counts (Tables 2 and 4b), 150 taxa belonged to the Pennales. The genera *Navicula* (31 taxa) and *Nitzschia* (25 taxa) and the family *Fragilariaceae* (27 taxa) were represented by the highest number of species. These diatoms, and in particular a few species, members of the genera *Fragilaria*, *Asterionella* and *Diatoma*, contributed most to the total quantities of the pennate diatoms, especially in the plume area.

Fragilaria crotonensis and *F. capucina* were found in maximum abundance at the middle plume; the highest counts were 628 and 246 cells/ml, respectively. The numbers of *F. crotonensis* decreased gradually toward the lake (ave. 183 cells/ml), those of *F. capucina* were higher in the lake (ave. 98 cells/ml) than at the edge of the plume (ave. 71 cells/ml). The minimum quantities of both species (1 - 25 cells/ml) occurred in the river. Other members of this genus, *F. brevistriata*, *F. construens* and *F. pinnata*, were very common at the surface in the river and were present in usually smaller numbers at the middle plume and edge of the plume. They were absent from or rare at the Lake station. *Fragilaria intermedia* and *F. leptostauron* were rather common in few collections from the river plume and lake.

Among members of the genus Asterionella, A. formosa was found in highest abundance, although A. gracillima occurred very abundantly in most collections. Variety A. formosa v. acaroides was abundant at the surface in the river (ca. 80 cells/ml) where it replaced the two former species. This entity was also very common at the surface of the middle plume and the bottom of the edge of the plume. Total populations of these three species in the river (ave. 110 cells/ml) and middle plume (ave. 100 cells/ml) were of similar sizes; they were much smaller at the edge of the plume (ave. 28 cells/ml) and in the lake ave. 34 cells/ml).

Diatoma tenue v. pachycephala was absent from the river, and occurred in high numbers (ca. 53 cells/ml) at station MP. It was present in lower quantities at EP (ave. 15 cells/ml) and Lake (ave. 7 cells/ml). Diatoma vulgaris was very common at the surface in the river, and rare at the remaining stations.

The abundance of Tabellaria fenestrata decreased from the middle plume (ave. 44 cells/ml) toward the lake (ave. 13 cells/ml). This species was rare in the river (1 cell/ml, at the surface).

The highest quantities of species belonging to the genera Navicula (max. 170 cells/ml), Nitzschia (max. 206 cells/ml) and Synedra (max. 192 cells/ml) were found at the surface in the river. The average numbers decreased toward the lake. The smallest counts of Navicula and Synedra in the lake ranged 3 - 8 cells/ml, those of Nitzschia 9 - 24 cells/ml.

Among 31 taxa of the genus Navicula included in the counts (Tables 2 and 4b), only two species, N. decussis and N. tripunctata, were present in all collections. The first entity was common in the river, and at the surface of the middle plume. It was found in highest numbers at the edge of the plume. The second species was most common in the river, and in bottom waters at the edge of the plume. Navicula cryptocephala v. intermedia was very common in the river, present in small numbers at MP and EP and was absent from the lake. Another entity, Navicula sp. (pygmaea v. producta) was rather common

at the surface in the river, and present in very small numbers in other collections, except those from the lake. Species such as N. latens, N. costulata, N. pupula v. mutata and N. menisculus v. upsaliensis were sporadically common in samples from stations MP, EP and Lake. Other members of the genus, such as N. gastrum, N. capitata or N. radiosa, were noted occasionally, always in low quantities.

Representatives of the genus Nitzschia, N. palea and N. frustulum v. perminuta, occurred in high quantities in the river, middle plume and edge of the plume, and were present in very small numbers in the lake. Nitzschia dissipata and Nitzschia sp. #2 were frequently found in the river samples, and occasionally were common in samples from EP (N. dissipata) or Lake (Nitzschia sp #2). Another entity, Nitzschia sp. #1 was common at the edge of the plume, and rare at the middle plume and lake. About 20 other members of this genus including N. amphibia, N. hungarica, N. stagnorum or N. woltereckii, were only found sporadically at either station, always in low quantities.

The genus Synedra was mainly represented by S. ulna and S. parasitica v. subconstricta. The former species was found in very high numbers in the river and in smaller abundance at the middle plume and edge of the plume. The latter was common at the surface in the river and also at stations MP and EP. It was absent from the lake. Entities such as S. ulna v. chaseana and S. ulna v. danica were present occasionally in samples from the PP, EP or Lake, always in low numbers.

Among many representatives of the genera Achnanthes, Amphora, Cocconeis and Gomphonema which were found usually in low abundance, only few occurred in all or most collections, and even fewer were present in rather high quantities.

Achnanthes lanceolata v. dubia, Amphora ovalis v. pediculus, Cocconeis placentula v. euglypta and C. pediculus were usually common or very common in samples from the river, middle plume and edge of the plume, and were absent from the lake.

Species such as Amphora neglecta, A. ovalis and its variety A. ovalis v. gracilis, A. siberica and Achnanthes pinnata were quite

common at the edge of the plume. Sporadically, small numbers of these entities were found at other stations.

Amphora michiganensis and Achnanthes minutissima, were very common at the surface in the lake, but were absent from all other sampling depths.

Rhoicosphaenia curvata and Gomphonema olivaceum were present in all collections, and occasionally were found in rather large abundance. The highest quantities of both species were observed in the river and edge of the plume. The smallest numbers occurred in the lake and in the case of G. olivaceum also in the middle plume.

4. Chlorophyta

In October collections green algae comprised between 4.14 percent (bottom, Lake) and 9.59 percent (bottom, EP) of the total phytoplankton. The average abundances decreased from the river (1365 units/ml) toward the lake (44 units/ml). The green algal flora was very diverse; 63 taxa were included in counts (Tables 3 and 4b). Among them, a few species occurred in very high numbers, (above 100 or even 200 units/ml), mainly in the river.

Species of Scenedesmus, S. quadricauda, S. abundans and S. incrassatulus, were found in much larger abundance, than other representatives of this genus. Their maximum counts from the river varied from 108 to 226 col/ml. The smallest quantities found in the lake ranged from 0.3 to 4 col/ml. Scenedesmus dimorphus and S. quadricauda v. maximus were present in all samples in much smaller numbers. Highest quantities of both species found at station PP were 45 and 31 col/ml, respectively. Other members of this genus, S. acutiformis, S. armatus, S. bernardii, S. bijuga and S. opoliensis, occurred only sporadically, with highest quantities in the river or middle plume (10 to 27 col/ml).

Populations of Ankistrodesmus falcatus and Dictyospherium pulchellum declined sharply from the river (maxima: 162 cells/ml at the bottom, and 129 colonies/ml, at the surface) toward the lake (minima: 4 cells/ml

and 1 col/ml, at the bottom). Another major dominant of the greens in the river, Actinastrum hantzschii (max. 142 cells/ml., at the surface), was also very common at the middle plume and edge of the plume, especially in surface waters but was absent from the lake station.

Oocystis solitaria occurred in very high quantities in the river (ave. 124 col/ml), in smaller numbers at the middle plume (ave. 55 col/ml) and edge of the plume (ave. 31 col/ml) and still smaller in the lake (ave. 9 col/ml). The numbers of a few entities included in combined counts of Oocystis spp. ranged from 3 col/ml (bottom, Lake) to 32 col/ml (bottom, PP).

Several species belonging to various genera, Closteriopsis longissima, Coelastrum sphaericum, Crucigenia apiculata, C. quadrata, Golenkinia radiata and Gloeocystis spp.,were present in all or most collections, occasionally in rather high abundance. The highest counts of these entities (16 to 41 units/ml) were recorded from the surface samples in the river or bottom samples of the middle plume.

Members of the genus Tetraëdron, T. caudatum, T. lunula, T. minimum and T. trigonum were found in practically all samples, with the maximum abundance in the river (10 to 41 cells/ml) and the smallest amounts in the lake (0.3 to 4 cells/ml).

High pulses of Dimorphococcus lunatus and Pediastrum duplex were observed in isolated instances. Thus the former species was present in numbers of 74 and 19 col/ml, at the bottom at stations PP and MP, and the latter was found in a quantity of 47 col/ml at the surface of PP. Both species were present in few other samples in much lower abundance (0.3 to 7 col/ml).

All the remaining members of the green algae, representatives of such genera as Cosmarium, Closterium, Desmatractum, Kirchneriella, Lagerheimia, Oocystis or Pediastrum were noted sporadically, usually in small numbers (0.3 to 6 units/ml).

5. Cyanophyta

Blue-green algae were found in low quantities; 17 to 29 units/ml. The relative abundance of this group in total phytoplankton increased

gradually from the river (0.14 percent) toward the lake (1.71 percent). Among 13 taxa identified in October (Table 3), only Phormidium spp., Oscillatoria spp., and Aphanocapsa spp. were found in all or most collections. Other members of this group were observed occasionally in quantities usually lower than 5 units/ml.

The highest numbers of Phormidium spp. (22 filaments/ml) and Oscillatoria spp. (7 fil/ml) were found in the river, the minimum (1 fil/ml) was noted in the lake.

Aphanocapsa spp. were absent from the river. The average populations at MP (7 col/ml), EP (10 col/ml) and Lake (9 col/ml) were of similar sizes.

Dactyloccopsis smithii was found at the surface of the river station in an abundance of 7 col/ml, it was absent from all other sampling depths except at the bottom in the lake (2 col/ml).

6. Chrysophyta

Dinobryon divergens was absent from the river and present at the MP, EP and Lake stations in numbers ranging from 10 cells/ml (at the surface and bottom in the lake) to 34 cells/ml (at the surface in the edge of the plume).

Ophiocytium capitatum v. longispinum (10 cells/ml, at the surface) and Centritractus belanophorus (4 cells/ml, at the bottom) were the only representatives of Chrysophyta found in the river. The former species and also Dinobryon bavaricum and D. calciformis were observed in isolated instances at stations MP and Lake in small quantities (1 to 4 cells/ml).

7. Pyrrophyta

This group of phytoplankton was absent from the river. At the middle plume, edge of the plume and lake, Pyrrophyta were represented by Peridinium spp. (1 to 5 cells/ml). A solitary case of Cystodinium sp. (17 cells/ml), was observed at the surface of the MP station.

8. Flagellates

Total counts of flagellates ranged from 183 cells/ml (at the surface, MP) to 397 cells/ml (surface, PP). The relative abundance in total phytoplankton increased from the river (2.06 percent) toward the lake (ca. 26.0 percent). This group was represented mainly by Chlamydomonas sp. and Cryptomonas sp. While the average populations of Chlamydomonas increased from the river (33 cells/ml) toward the lake (256 cells/ml) by a factor of about eight, the average concentrations of Cryptomonas diminished drastically, over 15 times, from PP (251 cells/ml) to the Lake (16 cells/ml).

Euglena spp (0.3 to 38 cells/ml) and Pteromonas sp. (1 to 11 cells/ml) were present in practically all samples; the maximum quantities were observed in the river and minimum in the lake.

Lepocinclis spp. and Phacus sp. were rather common (1 to 21 cells/ml) in a few samples from the river and middle plume.

C. November 6, 1968

1. Physical-Chemical Data

The river was colder than the adjacent lake waters, and was sinking in entering the lake. The plume could not be distinguished by its usually dark brown color. To increase the possibility of finding the edge of the plume, two EP stations were chosen (Fig. 1c).

Table 5c(1) presents the physical data. The surface water temperature varied from 10°C in the river to 12.5°C at the lake station located 4 km west from the shore. With the exception of the river station (PP), where no vertical temperature difference in the water column was observed, the surface temperature readings at the remaining stations were slightly higher (0.5 - 2°C) than those at 5 and 10 meters depth or at the bottom (Table 6*l*).

Secchi disc transparencies increased from 1.2 m in the river to 7.5 m in the lake. The highest amount of light, 6.66% of surface light at disc depth (5 m), was noted at EP 2 station where the water was clear green. Calculations indicated that the bottom waters at the middle plume contained 21% river water.

Examination of Table 5c(2) shows, that the highest average values of chemical parameters, with the exception of results for oxygen (max. 8.00 ppm at Lake, EP 2), and pH (max. 8.56 at EP 1), were found in the river. The lowest values were generally observed at the edge of plume stations. Slightly higher average results from the lake compared to those found at both EP stations, were in most cases, caused by high individual values from deeper water (e.g., nitrate, silica, chloride and turbidity values at 25 meters and bottom). The vertical distributions of chemical values at various segments of water columns are presented in Tables 6a - 6k (November data). The results obtained for orthophosphate may be of special interest (Table 6g); a complete depletion of orthophosphate was noted at 1 and 5 meters depth at MP and EP 1 stations, respectively, and only small amounts, ranging from 1.2 - 4.9 ppb were found at various depths of both EP stations and in the lake. The results

are striking when compared with the values found in the river (ave. 86.7 ppb) and at the bottom of MP station (65.1 ppb).

2. Phytoplankton Data

Figure 4a illustrates the average counts of total phytoplankton and of major phytoplankton groups found at the November stations. The total phytoplankton numbers at the middle plume station were about 2.5 times smaller in comparison with those in the river (ave. at PP: 6196 units/ml). The decrease from MP to the lake was small, the average counts at EP 1 and EP 2 were nearly the same, 2418 and 2441 units/ml, and only slightly smaller than at MP (ave. 2578 units/ml), the average numbers at the lake station were: 1542 units/ml.

For comparison, Figure 4b shows the average nutrients and silica values obtained at the same stations. A drastic decrease (ca. four times) of phosphate, nitrate and silica from the river to the middle plume, corresponded with the sharp decrease of total phytoplankton, diatoms and greens, abundances. At MP, both EP and Lake, where the total phytoplankton populations were of similar sizes, the levels of nutrients and silica were also similar.

3. Bacillariophyta

Diatoms comprised between 45.58 and 93.88 percent of the total phytoplankton in November collections. The maximum count, 5629 cells/ml, was recorded from the bottom in the river, the smallest, 335 cells/ml, from 10 meters depth in the lake. In the river (PP), centric diatoms dominated, by far, the total phytoplankton populations. In the river plume area (MP, EP 1, EP 2) and the lake station, the relative abundance of the Centrales decreased drastically. While the percent composition of the Centrales at these stations varied from 12.68 to 58.24% the Pennales made up between 29.22 and 66.82% of the total phytoplankton. In only one sample, from the bottom of the middle plume, the numbers of total Pennales were about twice as small as those of the centric diatoms. The cell counts of diatoms and their relative abundance in total phytoplankton are presented in Tables 1 and 2 (November data).

About 13 species of the Centrales were found in very high or relatively high, quantities in this month's collections. Several of them occurred abundantly in the river, and in smaller although sporadically very high numbers at other stations, especially at the bottom. Generally, their average concentrations were sharply decreasing, toward the lake, and the numbers found in deeper and bottom waters were higher and often much higher than those observed in upper and surface waters.

The maximum counts for Cyclotella meneghiniana v. plana (3171 cells/ml) and for Melosira granulata v. angustissima (597 cells/ml) were found at the bottom in the river; the concentrations were only slightly higher than those at the surface. The minimum counts for the former species were: 9 cells/ml in the 5 meter sample from EP 2 and 10 cells/ml in the 7 m sample from MP, and for the latter species: 11 cells/ml at 10 meters depth in the lake.

Populations of Melosira granulata at the surface and bottom in the river, and bottom of the middle plume station were essentially identical, ca. 473 cells/ml. The lowest numbers, 8 cells/ml, were found at the surface in the lake station.

Stephanodiscus tenuis and S. subtilis were found in the river in maximum quantities of 317 and 195 cells/ml respectively. The minimum counts for both species, 1 - 4 cells/ml, were noted at various depths at the remaining stations.

In addition to these major dominants in the river phytoplankton, few other species were very common in the river and present in lower numbers at various depths at the plume stations and in the lake. The average counts of Stephanodiscus hantzschii decreased from 26 cells/ml in the river to about 2 cells/ml in the lake. Stephanodiscus astrea occurred in an abundance of 48 cells/ml at the bottom in the river, its counts from all of the other samples ranged from 2 - 16 cells/ml. Another representative of genus Melosira, M. varians was very common (16 - 28 cells/ml) in the river. It was found in only three other samples from the lake and edge of the plume in low numbers of 1 - 6 cells/ml. Coscinodiscus subsalsa was very common in the river

(max. 68 cells/ml, at the surface) and at the bottom of MP (38 cells/ml) and EP 2 stations (25 cells/ml). The numbers found in other samples from MP, EP 1 and lake were much smaller, 1 - 5 cells/ml.

Four species were found in large abundance either at the middle plume or the edge of the plume stations. Their lowest counts were recorded from the river or lake samples. Thus Cyclotella comta occurred in high numbers of 133 cells/ml at the bottom of station EP 2, the minimum 9 cells/ml, was found at the surface in the lake. The counts of C. kützingiana ranged from 10 cells/ml in the river to 129 cells/ml in the middle plume. The highest populations of Stephanodiscus alpinus (152 cells/ml) and Cyclotella michiganiana (106 cells/ml) were found at the bottom of MP, the lowest counts, 1 and 5 cells/ml, at 10 meters depth in the lake.

Pennales were found in largest abundance at station EP 1, with an average of about 1230 cells/ml. The average concentrations at MP, EP 2 and Lake were similar, about 900 cells/ml. The lowest quantities, ave. 330 cells/ml, were found in the river. Except for the river station where relatively low numbers (1 - 19 cells/ml) of Fragilaria crotonensis were noted, the populations of this species at other stations and to a lesser degree those of F. capucina, outnumbered the quantities of all other pennate diatoms. The maximum cell counts of F. crotonensis, 1034 and 901 cells/ml, were recorded from the bottom of stations EP 1 and EP 2, respectively. The highest populations of F. capucina were found at the bottom of EP 1, 386 cells/ml, and at the bottom of Lake station, 181 cells/ml. Other members of the genus Fragilaria such as F. brevistriata, F. construens, F. pinnata and its variety F. pinnata var. lancettula, were present in relatively high quantities in the river, and were rather common in bottom waters at all other stations. Fragilaria construens v. binodis was common in the river and practically absent from the remaining stations.

Several members of the genera Asterionella and Diatoma were found in the November collections. The maximum total counts were: for the former genus, 149 cells/ml, and for the latter, 113 cells/ml,

noted at the bottom of station EP 1. The lowest numbers of both genera occurred in the river. The genus Asterionella was mainly represented by A. formosa. A. gracillima and A. formosa v. acaroides were also identified in several collections. Among species of the genus Diatoma, D. tenue v. elongatum was most numerous and present in all samples. Diatoma tenue v. pachycephala was rather common at station EP 1 and D. vulgaris was common in samples from the river and present in smaller numbers in bottom samples from other stations.

The average populations of Tabellaria fenestrata found in the lake and at both edge of the plume stations were of similar sizes, ca. 36 - 40 cells/ml. The numbers in the middle plume were smaller, about 20 cells/ml, and much lower in the river, 2 cells/ml. Tabellaria fenestrata v. geniculata was present in very low quantities in several samples from the river plume area and lake. T. flocculosa was very common (18 cells/ml) in only one sample from 7 m depth in the middle plume.

Contrary to the representatives of the Pennales discussed above, found in lowest numbers in the river, members of the genera Navicula, Nitzschia and Synedra occurred in the river in highest quantities. Their average numbers were decreasing toward the lake. Among 211 diatom taxa identified in the November collections (Table 4c), the highest number, 45, were members of the genus Navicula. About 28 of them were found in the river in average quantities of 103 cells/ml. The amounts at the remaining stations, contributed by varying numbers of species (2 - 28) ranged from 0.1 - 24 cells/ml. In spite of such high diversity of species, only several members of the genus Navicula were found commonly in various samples, especially those from the river. Others, as N. lanceolata, N. integra or N. pupula and its varieties, were only found occasionally, usually in very low abundance.

Navicula decussis present at all stations, was very common in the river and common in deeper or bottom water at other stations. Navicula cryptocephala v. intermedia, N. gastrum, N. tripunctata and its variety N. tripunctata var. schizonemoides were very common in the river, and less common at the bottom of MP and EP 2 stations. They

were only sporadically found in very small numbers at other stations. Navicula paludosa was commonly found only in the river and at the bottom of the middle plume. Navicula costulata and N. latens, absent from the river, were present at various depths of other stations usually in low quantities and only occasionally they were more common at MP, EP 1 or EP 2. Navicula menisculus v. upsaliensis and varieties of N. capitata, especially N. capitata v. luneburgensis were found at all stations, most of the time in very small numbers. Both mentioned species were sporadically common at the bottom of MP, EP 1 and EP 2.

Total cells counts of the genus Nitzschia decreased gradually from the river (max. 94 cells/ml, bottom) toward the lake (minim. 2 cells/ml, at 10 meters). Among 22 identified members of this genus, only N. amphibia and N. dissipata were relatively common and present in most collections. Entities marked as Nitzschia sp. #1 and Nitzschia #2 were common at the EP 1 station, Nitzschia sp. #1 was also quite common in the lake, and Nitzschia sp. #2 was rather common in the river and the surface of the middle plume. Other species in this genus were found in small numbers, usually in samples from deeper water.

Total abundance of species belonging to the genus Synedra varied from a minimum of 1 cell/ml (at 10 meters, lake) to a maximum of 32 cells/ml (surface, river). Synedra ulna, S. ulna v. chaseana and S. acus were found most frequently, although usually in low quantities. Only S. ulna was more numerous than other species of this genus, especially in the river and at various depths of MP, EP 2 and Lake. Synedra sp. (vaucheriae v. fragilarioides) was common in bottom samples from EP 1 and Lake.

In addition to the diatoms included in the above discussion, several other species, representatives of such genera as Achnanthes, Amphora and Cocconeis were often found in relatively high numbers at the November sampling stations, especially in the river or deeper water of the river plume area. Common in the river and deeper water at MP, EP 2 and occasionally in the lake were: Achnanthes lanceolata v. dubia, Amphora ovalis v. pediculus and the nominate variety A. ovalis, Cocconeis diminuta and C. placentula v. pediculus. Species such as

Achnanthes clevei and Cocconeis pediculus were quite common in the river and more common in deeper water of the middle plume. Achnanthes lanceolata was common in the river, at the bottom of station EP 2 and at 25 m depth in the lake. Relatively common in the river, and absent from, or rare, at the other stations were: Achnanthes hauckiana v. rostrata and A. lauenburgiana. Very rare in the river, but very common in deeper water in the middle plume, the edge of the plume and lake was Amphora neglecta. Common only at the bottom of station MP and EP 2 and rare in the river, EP 1 and lake were: Amphora ovalis v. libyca, Cocconeis placentula and C. thumensis.

Solitary members of other genera, e.g., Rhoicosphenia curvata and Gomphonema olivaceum, were very common in the river, and sporadically common in bottom or deeper water at MP, EP 2 and Lake stations.

4. Chlorophyta

Percent composition of green algae in total phytoplankton varied from 1.22 to 6.36%, and the total counts ranged from 20 units/ml (at 10 meters, lake) to 413 units/ml (at the bottom, in the river). The average counts decreased from the river to the middle plume by the factor of 4.5. At the middle plume, lake and especially at both edge of the plume stations the counts were similar, ranging from 52 units/ml (Lake) to 80 units/ml (MP).

Among 55 taxa of the greens included in the November counts (Table 3) only a few were found in most collections, at times in rather high abundance. Most of the species, representing such genera as Pediastrum, Gloeocystis, Kirchneriella, Scenedesmus or Crucigenia occurred sporadically, usually in low quantities (0.3 - 5 units/ml).

Two members of the genus Scenedesmus, S. quadricauda and S. dimorphus, were found very frequently. Their highest populations, 126 and 30 colonies/ml, respectively, were observed at the bottom in the river.

Scenedesmus abundans, S. incrassatulus, and S. quadricauda v. maximum were relatively common in the river and at the bottom of the middle plume; their counts ranged from 3 - 15 col/ml.

Genus Oocystis was mainly represented by O. solitaria. This species was found abundantly in the river (121 col/ml, bottom), and was very common at the middle plume and at the bottom of EP 2 and Lake stations. The minimum, 2 col/ml, occurred at the bottom of EP 1 station. Several other taxa were included in total counts of Oocystis spp., the numbers ranged from 1 col/ml (at 25 meters, lake) to 31 col/ml (surface, river).

Ankistrodesmus falcatus was present in all collections. Its average numbers decreased sharply from the river (59 cells/ml) to the lake (3 cells/ml). The populations at the MP, EP 1 and EP 2 stations were of similar sizes: 9 - 13 cells/ml.

Dictyospherium pulchellum was found at all stations, most of the time in low numbers, 0.6 - 4 col/ml. The maximum, 10 col/ml, was observed at the bottom in the river.

Isolated high pulses of entites absent from most collections or present in low numbers, were observed in few instances. Thus Cosmarium spp. were found in abundance of 62 cells/ml at 5 meters depth of station EP 1, and Crucigenia quadrata occurred in numbers of 32 col/ml at the surface in the lake.

5. Cyanophyta

Total counts of blue-greens varied from 7 units/ml (at 25 m, lake) to 52 units/ml (at the surface of the middle plume). Several species of genus Oscillatoria were present in most samples. They were the only representatives of the blue-green algae found in the river. The highest counts of Oscillatoria were recorded from the surface of station EP 1 41 fil/ml, and from the surface of station PP, 37 fil/ml. The lowest numbers, ave. 1 fil/ml, were found in the lake.

Aphanocapsa spp. absent from the river, were relatively common at other stations; the highest counts, 5 - 8 colonies/ml, were noted in surface waters.

Chroococcus limneticus and few other members of this genus were observed in the same collections. The maximum quantities of C. limneticus

(14 col/ml) and of species included in total counts of the genus Chroococcus (26 col/ml) were noted at the surface of the middle plume. The lowest counts (0.3 - 4 col/ml) were found in the lake.

Anabaena circinalis was present in numbers of 0.3 - 4 col/ml, at the edge of the plume and in the lake.

6. Chrysophyta

Dinobryon divergens was found at all stations in small numbers (1 - 4 cells/ml). An isolated pulse of entities belonging to genus Mallamonas was noted at 5 meters depth of station EP 1: 15 cells/ml. Members of this genus and of genus Ophiocytium were observed in very low quantities in few other collections.

7. Pyrrophyta

Members of genus Peridinium were found in several samples in low abundance of 1 - 3 cells/ml.

8. Flagellates

Flagellates, represented mainly by the genera Chlamydomonas and Cryptomonas, were found in high abundance in November collections, especially in those from the edge of the plume. The total counts ranged from 77 cells/ml (at the bottom, lake) to 1092 cells/ml (at 5 meters, EP 2). The average numbers of Chlamydomonas at each station exceeded several times those of Cryptomonas. Their maximum concentrations at the middle plume, edge of the plume, and in the lake were observed in upper segments of water columns; peaks of 990 and 733 cells/ml were noted at 5 meters depth of the EP 2 and EP 1 stations. The smallest quantities of Chlamydomonas, 32 cells/ml, were observed at the surface in the river; the numbers were ten times smaller than those at the bottom. At the surface in the river Cryptomonas occurred in highest abundance of 114 cells/ml. Their lowest counts (7 - 36 cells/ml) were recorded from the lake.

Members of the genus Pteromonas were present at each station. The cell counts ranged from 0.3 cells/ml noted at the surface in the lake to 20 cells/ml recorded from the surface in the river.

Euglena spp. and Phacus sp. occurred in few samples in small numbers (0.3 - 3 cells/ml).

D. March 18, 1969

1. Physical-Chemical Data

Ice floating from the river into the lake indicated the direction of the river flow. The edge of the plume station was chosen at the edge of the melting ice (Fig. 1d).

Tables 5d(1) and 6*l* present the physical data. In the river, the surface and bottom temperatures were the same (4.2°C). At the middle plume and edge of the plume (surface temperature, 2°C), and at the lake station (surface temperature, 2.5°C), the surface water was slightly colder than at the bottom. The maximum temperature difference between the surface and bottom was 2°C at the MP station. The Secchi disc readings ranged from 1.3 m in the river to 3.5 m in the lake. The amount of surface light at disc depth varied from 1.75 percent in the river to 13.28 percent at 2.5 meters, EP and 13.96 percent at 1.5 meters, MP.

Calculations indicated a higher content of the river water at the bottom of stations MP (46.0%) and EP (19.0%) than at the surface.

The average chemical results are summarized in Table 5d(2), and the individual values of chemical parameters are presented in Tables 6a to 6k. Except for dissolved oxygen content and pH (identical surface and bottom oxygen results at each station: 12.0 ppm, and only slight differences between stations in the hydrogen ion concentrations, 8.83 to 8.90) the average values of chemicals were higher in the river than in the mixing water area (MP, EP), and considerably higher than in the lake. In general, at each station, the surface results for sulfate, chloride, alkalinity, phytoplankton nutrients and silica were lower, and at times much lower than the bottom values. Departures from this pattern were observed in only a few cases (e.g., uniform vertical distribution of alkalinity values at the PP and Lake stations, of phosphate in the river, or higher than at the bottom, surface value of silica in the river). Some of the higher differences

between the surface and bottom results were noted for phosphates (Table 6g). In the middle plume, the surface phosphate value was 15.2 ppb, and the bottom value was 56.0 ppb. Complete depletion of phosphate was found at the surface in the edge of the plume, while the bottom value was 35.6 ppb. Also the surface values of silica at MP (5.10 ppm) and EP stations (5.00 ppm) were 1.30 and 2.00 ppm lower than those at the bottom (Table 6h).

2. Phytoplankton Data

Figures 5a and 5b illustrate the surface and bottom counts of total phytoplankton and of major phytoplankton groups. The maximum concentration of phytoplankton, 6180 units/ml, was observed at the surface of the edge of the plume station; the quantities exceeded more than twice the bottom populations (2612 units/ml). The second highest count, 3277 units/ml, was recorded from the bottom in the lake, however the average quantities of phytoplankton at this station (2966 units/ml) were nearly of the same size as those found in the middle plume (3100 units/ml). The minimum numbers were observed in the river--the average quantity in the river was 1983 units/ml.

Comparison of Figures 5a,b with Figures 5c,d shows that the levels of total phytoplankton and diatoms in the mixing area (MP, EP) and lake were much higher than in the river and corresponded with nutrients and silica values much reduced relative to the river values. These results, and also the fact that the surface concentrations of nutrients and silica were generally lower than the respective bottom values (especially at the edge of the plume where maximum populations of phytoplankton were observed, and at the same time phosphate at the surface was depleted and nitrate and silica values were much smaller compared with the bottom concentrations) would suggest an enhanced uptake of nutrients and silica in the photic zone, by the spring phytoplankters. This biological uptake of nutrients and phytoplankton bloom was most probably triggered by more appropriate temperature

and light conditions for the spring phytoplankton in the mixing water area and lake than in the river [see Table 5d(1)].

3. Bacillariophyta

In collections from the middle plume, edge of the plume and lake diatoms comprised between 83.42 percent and 93.10 percent of the total phytoplankton. In the river samples their relative abundance was smaller: 59.27 percent (surface collection) and 71.12 percent (bottom collection). The maximum count, 5754 cells/ml, was recorded from the surface of the edge of the plume; these quantities were over twice the size of the amounts found in the bottom waters at this station. The minimum numbers, 910 cells/ml, were observed at the surface in the river. At each station, centric diatoms were found in much higher abundance than Pennales; their percent composition in total phytoplankton varied from 39.16 percent (surface, PP) to 74.20 percent (surface, EP), while the pennates made up between 16.47 percent (bottom, PP) and 31.41 percent (surface, MP) of the total.

Examination of Tables 1 and 2 shows that species of the Centrales found in March in large quantities in the river, were entirely different from those dominating the diatom flora in the mixing water area (the middle plume and edge of the plume) and lake. They were the same as during the fall (September, October and November) but present in different proportions and in much lower numbers, in fact, the numbers were extremely small, compared with those in the previous season.

The maximum counts of all but one centric diatom found in the river were recorded from the bottom. Quantities of these species found at stations MP, EP and Lake, were much smaller. The highest numbers of *Stephanodiscus subtilis* and *S. tenuis* were 431 and 292 cells/ml (river, bottom). The quantities found in the collections from other stations ranged, for the former species, 10 to 28 cells/ml, and for the latter, 6 to 16 cells/ml.

Cyclotella meneghiniana v. plana (maxima: 361 cells/ml at the bottom in the river and 281 cells/ml at the surface in the river), was not found at the Lake station. The average populations at the middle plume and edge of the plume were: 60 and 33 cells/ml, respectively. The nominate variety of the former species C. meneghiniana (max. 112 cells/ml, surface, river) was identified at all sampling depths. Its average populations decreased toward the edge of the plume (17 cells/ml), the amounts found in the lake (ave. 33 cells/ml) were similar to those in the middle plume (ave. 37 cells/ml).

Melosira granulata and M. granulata v. angustissima (highest counts: 28 and 67 cells/ml, respectively, at the bottom in the river) were present in all collections. Lowest abundance of both species (4 to 5 cells/ml) was noted at stations MP and EP. The average quantities in the lake, 9 cells/ml, for the former species, and 15 cells/ml for the latter, were much smaller than those in the river.

Several centric diatoms, Stephanodiscus alpinus, S. transilvanicus, Cyclotella stelligera, C. ocellata, Melosira islandica, M. italica subsp. subarctica and Stephanodiscus minutus, were found in high, and at times very high abundance at stations MP, EP and Lake. Their quantities were often much higher compared with the amounts observed during the fall. Two of these species (M. islandica and M. italica subsp. subarctica) were not present in the fall collections. The maximum populations of these phytoplankters with only one exception of M. islandica, (highest numbers at the surface in the lake), were observed at the surface in the edge of the plume. These quantities, especially in the case of S. alpinus and S. transilvanicus were much higher than the respective numbers found in the bottom waters at the same station. Only the surface and bottom populations of M. islandica and those of M. italica subsp. subarctica were uniform. In most cases, the average abundances of any of these species, at at least two sampling stations, either the EP and Lake, the MP and EP or the MP and Lake, were of similar, if not identical sizes. Most of these entities were absent from the river, and when present, their numbers were small.

The maximum counts of Stephanodiscus alpinus and S. transilvanicus were: 2116 and 903 cells/ml (surface, station EP). The average populations of the former species, found in the middle plume and lake were similar, ca. 600 to 700 cells/ml. Small numbers (10 cells/ml) were recorded from the bottom sample in the river. Stephanodiscus transilvanicus was absent from station PP, the average amounts found at the edge of the plume and lake were almost identical (500 cells/ml) and over twice the quantities found in the middle plume (ave. 212 cells/ml).

Cyclotella stelligera and C. ocellata (highest numbers: 475 and 380 cells/ml, at the surface, station EP) were practically absent from the river; only small quantities of the former species (4 cells/ml) were observed at the bottom. The average populations of C. stelligera at stations MP (326 cells/ml) and EP (391 cells/ml) were of similar sizes, and over four times higher than those in the lake (ave. 75 cells/ml). The abundance of C. ocellata in the edge of the plume (ave. 244 cells/ml) was larger than in the lake (ave. 158 cells/ml) and middle plume (ave. 78 cells/ml).

Both Melosira islandica (maximum 330 cells/ml at the surface in the Lake) and M. italica subsp. subarctica (max. 77 cells/ml, surface, station EP) were absent from the river. The average abundances of the former species at the EP and Lake stations, were identical (ca. 264 cells/ml). The quantities in the middle plume were smaller, (ave. 156 cells/ml). The numbers of the latter species increased from the middle plume (ave. 49 cells/ml) to the edge of the plume (ave. 67 cells/ml) and then decreased toward the lake (ave. 27 cells/ml).

Stephanodiscus minutus was present in all collections in numbers ranging from 24 to 166 cells/ml. The highest average quantities (143 cells/ml) were found in the middle plume, the lowest (52 cells/ml) in the river.

Several centric diatoms, Cyclotella comta, C. kützingiana, C. michiganiana, Melosira varians and Stephanodiscus astrea, were present in few collections, sporadically in rather high numbers. Except for C. comta they were not found in the lake. Their maximum

quantities (20 to 49 cells/ml) were observed in the middle plume and edge of the plume, only C. comta was most common at the bottom in the lake (35 cells/ml) and M. varians at the bottom in the river (15 cells/ml).

Isolated pulses of few other species were observed occasionally. Thus Stephanodiscus hantzschii was present at the bottom in the middle plume (11 cells/ml) and S. binderanus occurred at the surface in the edge of the plume (15 cells/ml). Coscinodiscus subsalsa was only found at the surface in the river (4 cells/ml) and Cyclotella cryptica at the surface in the middle plume and edge of the plume (5 cells/ml).

In this month's collections Pennales were represented by 158 taxa. Most of them belonged to the family Fragilariaceae (39), Navicula (38) and Nitzschia (24). The remaining species were members of such genera as Achnanthes, Amphora, Cocconeis, Gomphonema and many others. Table 4d shows the numbers of identified taxa in the March samples. The cell counts of pennate diatoms are presented in Table 1, and the relative abundance of species in total phytoplankton, in Table 2.

The maximum quantities of Pennales (1168 cells/ml) were found at the surface in the edge of the plume, and the minimum numbers (308 cells/ml) at the surface in the river. The highest average counts of any of the major genera of this group of diatoms, with the exception of the genus Navicula (maximum in the river) were reported either from station EP or MP. The lowest counts were generally found in the river.

Members of the genus Fragilaria, Fragilaria crotonensis and F. capucina, occurred in largest abundance at the surface of station EP, 312 cells/ml and 72 cells/ml, respectively. The former species was absent from the river, and the lowest quantities, 92 cells/ml, were observed at the surface in the lake. The smallest numbers of the latter species (ave. 8 cells/ml) were found at both the river and middle plume stations. A variety of F. capucina, F. capucina v. lanceolata, was common in the river and also at the surface in the

middle plume and edge of the plume. Smaller numbers were found at the bottom of stations MP and EP. Another variety, F. capucina v. mesolepta was found in low abundance in the river and middle plume. Fragilaria vaucheriae v. truncata was very common in the river, and present in smaller quantities at the bottom of stations MP and EP. Variety F. vaucheriae v. capitellata was very common at the surface in the edge of the plume. Fragilaria construens was rather common in surface waters in the river and middle plume. This species and its varieties, F. construens v. binodis and F. construens v. pumila occurred also at few other sampling depths, in much lower quantities. Fragilaria brevistriata, F. brevistriata v. inflata, F. pinnata and F. pinnata v. lancettula were sporadically present in samples from stations PP, MP and EP.

Maximum abundance of members of the genus Synedra was recorded from the middle plume (ave. 242 cells/ml). Smaller populations, found at the edge of plume (ave. 137 cells/ml) and lake (140 cells/ml) were almost of identical sizes. The lowest quantities (ave. 19 cells/ml) were observed in the river. Among 13 species of this genus identified in samples from the river, only Synedra ulna, and to a lesser degree S. ulna v. danica were common. All of the remaining entities were present in very small numbers. The former species was also present in lower abundance at the bottom of the edge of the plume and lake. Abundance of the latter species increased toward the lake, with the highest numbers found at the edge of the plume. Synedra ulna v. chaseana and the entity designated as Synedra sp. (vaucheriae v. fragilarioides) occurred in very high quantities in the middle plume, edge of the plume and Lake, they were practically absent from the river. Common at the surface in the middle plume were S. acus and S. delicatissima v. angustissima. While the former species was present only in small numbers at all other sampling depths, the latter entity was absent from the river, but very common at the edge of the plume and somewhat less common at the bottom in the lake. Rather high numbers of another member of this genus, S. ostenfeldii were observed in the edge of the plume.

Average populations of Tabellaria fenestrata in the middle plume (98 cells/ml), edge of the plume (100 cells/ml) and lake (81 cells/ml) were of similar sizes. Only small quantities (ca. 3 cells/ml) of this organism were present in the river.

Genus Asterionella was represented mainly by Asterionella formosa. Other species of this genus, A. gracillima and A. formosa v. acaroides, were identified only in the surface sample from the middle plume. The average concentrations of Asterionella in the middle plume and edge of the plume (ca. 87 cells/ml) were identical, and over twice the size of the quantities found in the river (ave. 32 cells/ml) and lake (ca. 39 cells/ml).

Diatoma tenue v. elongatum, present in all collections, was the most common member of the genus Diatoma. A few other species in this genus, Diatoma vulgaris and its variety, D. vulgaris v. brevis, D. ehrenbergii and D. tenue, were found in the river, especially in the bottom waters, in total numbers higher than the former species. The highest counts of Diatoma were recorded from the middle plume (ave. 42 cells/ml) and edge of the plume (ave. 34 cells/ml). Much smaller quantities were observed in the lake (ave. 10 cells/ml) and the lowest (ave. 6 cells/ml) in the river.

Representatives of the genus Nitzschia were present in largest abundance at stations MP (ave. 159 cells/ml) and EP (150 cells/ml). The lowest numbers were found in the river (ave. 68 cells/ml). Four species in the river contributed mostly to the total quantities of Nitzschia: Nitzschia linearis, the entity designated as Nitzschia sp. #6, N. commutata, and N. dissipata. The three former entities were either absent from all other stations, or occurred there only in very low amounts (Nitzschia sp. #6). The species, Nitzschia dissipata, was also very common in the middle plume, especially at the surface and present in somewhat smaller numbers in the edge of the plume.

Nitzschia sp. #2 was found in particularly high quantities at stations MP, EP, and Lake, where it made up over 80 percent of the total numbers of Nitzschia. It was found in very low abundance in

the river. Another entity, Nitzschia sp. #1 was common in the edge of the plume and lake, especially at the bottom. It was absent from the river, and present at the MP station in small numbers. Nitzschia recta and N. acuta occurred in all samples, with the exception of those from the lake. Both species were usually found in low abundance. Other members of this genus were only found sporadically, in small quantities.

An average abundance of the genus Navicula decreased from the river (79 cells/ml) toward the lake (ave. 9 cells/ml). Several representatives of this genus, Navicula tripunctata, N. cryptocephala v. intermedia, N. cryptocephala v. veneta, N. decussis, N. gregaria and N. radiosa v. tenella, were common or very common in the river, and sporadically common in the middle plume or edge of the plume. Other species, such as N. capitata, N. lanceolata, N. viridula, N. viridula v. linearis and Navicula sp #8, were usually common in the river and occasionally present in much smaller quantities at the other stations. Most members of this genus were found only sporadically, in low abundance.

Many other representatives of various genera were frequently found in the March collections. However, only some of them were present in relatively high quantities. Thus Gomphonema olivaceum was very common in the river and middle plume, less common at the bottom in the edge of the plume and lake, and was practically absent from the surface waters of the two last stations. Species of the genus Achnanthes, A. lauenburgiana, and A. lanceolata with its variety A. lanceolata v. dubia, were very common in the river, especially at the surface. They were also present in small quantities at other stations. A few species of Amphora, Amphora ovalis and its varieties, particularly A. ovalis v. pediculus, were present in all samples; they were more common in the river and middle plume. Meridion circulare, M. circulare v. constrictum and Rhoicosphaenia curvata were common in the river. Surirella ovata, and S. ovata v. pinnata were quite common at the bottom in the river and S. angustata in surface waters of the middle plume and the edge of the plume.

4. Chlorohpyta

Green algae comprised between 0.45 percent (bottom, station EP) and 1.45 percent (bottom, river) of the total phytoplankton. The highest count, 71 units/ml, was recorded from the surface in the edge of the plume, and the lowest, 8 units/ml, from the surface in the river. Among twelve taxa of the greens identified in the March collections (Table 3) only two were found in relatively high numbers.

The maximum quantities of *Ankistrodesmus* spp. (20 to 26 cells/ml) were observed in surface samples from stations MP, EP and Lake. The smallest amounts (ca. 3 cells/ml) occurred in the river.

The counts of *Oocystis solitaria* ranged from 2 col/ml (surface, station PP) to 31 col/ml (surface, station EP).

All other members of the green algae, i.e., *Closterium* sp., *Oocystis borgei*, *Closteriopsis longissima* and a few species of the genus *Scenedesmus*, were found only occasionally, in low abundance (0.6 to 6 units/ml). In most cases they were absent from the lake station.

5. Cyanophyta

Blue-greens made up only a very small portion (0.07 percent to 0.74 percent) of the total phytoplankton.

Oscillatoria spp. were found in quantities ranging from 1 fil/ml (surface, PP) to 12 and 16 fil/ml (in bottom waters of the lake and edge of plume stations, respectively).

Chroococcus turgidus (9 col/ml) and *Dactyloccopsis smithii* (4 col/ml) were only observed at the surface in the lake.

Aphanocapsa spp. (ca. 2 col/ml) were present in the edge of the plume.

6. Chrysophyta

Dinobryon divergens was found in maximum quantities (13 cells/ml) at the bottom in the river. Counts of this entity from other sampling depths ranged from 1 to 5 cells/ml.

7. Pyrrophyta

Peridinium spp. were only present in the river, middle plume and edge of the plume, in low abundance (0.8 to 4 cells/ml).

8. Flagellates

This group of algae comprised at least 5.58 percent and at most 39.61 percent of total phytoplankton. The highest average concentrations of flagellates (626 cells/ml) were found in the river, the lowest (298 cells/ml) in the edge of the plume.

Chlamydomonas was present in maximum quantities (248 cells/ml) at the bottom of the lake station. The smallest numbers (28 cells/ml) were noted at the surface in the river. Average populations of *Chlamydomonas* in the middle plume (115 cells/ml) and edge of the plume (112 cells/ml) were of identical sizes.

Abundance of *Cryptomonas* sp. decreased from the river (ave. 45 cells/ml) to the middle plume (ave. 18 cells/ml) and then increased gradually toward the edge of the plume (ave. 28 cells/ml) and lake (ave. 39 cells/ml).

Several entities included in total counts of "undetermined flagellates" made up a very high portion of the total flagellates in this month's collections. The maximum quantities of this group (ave. 535 cells/ml) were found in the river, the minimum (ave. 157 cells/ml) at the edge of the plume.

E. April 17, 1969

1. Physical-Chemical Data

During several days preceding sampling and on the sampling day the wind was mild and variable. In entering the lake the river plume was forming a bulge over 1 km long and 1 km wide (Fig. 1e).

Tables 5e(1) and 6ℓ present the physical data. The surface water temperature decreased from 13.0°C in the river to 4.0°C in the lake. The vertical temperature readings were uniform in the river, and nearly uniform at the EP and Lake stations. A temperature gradient in the water column was observed at station MP, where the surface temperature (9.0°C) was 3.5°C higher than at the bottom.

Secchi disc transparencies varied from 0.5 m in the river to 4 m in the lake. The amount of surface light at disc depth ranged from 4.50 percent in the river to 14.0 percent in the edge of the plume (at 2.8 meters).

Calculations indicated that the surface waters at the middle of the plume contained 26% of the river water. No river water was found at station EP.

Table 5e(2) shows the average chemical results. The highest values, except for dissolved oxygen (maximum at EP 12.5 ppm and Lake 12.0 ppm) and pH (max. at EP 8.90), were observed in the river. The minimum values were usually found at the edge of the plume. The results from lake water, higher than those from station EP, and in the case of silica, higher than in the middle plume, were influenced by particularly high bottom values (e.g., bottom concentrations of nutrients, carbon dioxide, alkalinity, sulfate, chloride) or surface values (silica), found at the lake station. The individual chemical results are presented in Tables 6a-6k. With only a few exceptions (e.g., uniform or nearly uniform at each station, surface to bottom distribution of oxygen and pH values) vertical variations in the distribution of values of most chemical parameters, at times rather pronounced (e.g., nutrients and silica at stations MP, EP and Lake), were observed at all sampling stations.

2. Phytoplankton Data

Figure 6a illustrates the average abundance of total phytoplankton and of major phytoplankton groups found in April. The shape of this figure (especially the lines for total phytoplankton and diatoms) is strikingly similar with the shape of Fig. 6b, showing the average values of nutrients and silica at the same stations. The highest concentrations of phytoplankton in the river (average 7026 units/ml), correspond with the maximum values of phosphate, nitrate and silica, and the smallest phytoplankton quantities in the edge of the plume (ave. 2353 cells/ml) correspond with the minimum chemical results found at this station. The cell counts of total phytoplankton and diatoms are presented in Table 1. Counts of other phytoplankton groups are shown in Table 3.

3. Bacillariophyta

Diatoms comprised between 77.97 percent (bottom, station EP) and 96.09 percent (surface, river) of total phytoplankton in the April collections. The highest count, 9037 cells/ml, was recorded from the bottom in the river, and the lowest, 1218 cells/ml, from the bottom in the edge of the plume. The quantities found at all other sampling depths ranged from 2227 cells/ml (at the surface in the lake) to 4108 cells/ml (at the surface in the river). In all collections the Centrales made up a higher, and often much higher, portion of total diatoms than the Pennales. In general, the relative abundance of the centric diatoms in total phytoplankton decreased, and of the Pennales, increased, from the river toward the lake (Table 2).

Most of the 15 species of centric diatoms, identified in collections from the river, were found in maximum concentrations at the river station, mainly at the bottom. All of them, and especially the major dominants in the river phytoplankton, as *Stephanodiscus hantzschii*, *Stephanodiscus minutus*, *Cyclotella meneghiniana* v. *plana* and *C. meneghiniana* were also present in the middle plume, edge of the plume and lake, however in quantities usually much smaller than in the river. With few exceptions, average counts of these species were sharply decreasing toward the lake.

The largest populations of S. hantzschii, and S. minutus, found at the bottom in the river, were 3547 and 1297 cells/ml respectively. The quantities of the former species found at other sampling depths ranged from 33 cells/ml (bottom, station EP) to 1415 cells/ml (surface, river). The average numbers at the lake station (414 cells/ml), were six times smaller than in the river, but were higher than the amounts found in the middle plume (275 cells/ml) and edge of the plume (178 cells/ml). Similarly the average populations of S. minutus in the lake (180 cells/ml), although much smaller than in the river (ave. 775 cells/ml), were larger than at the stations MP (ave. 82 cells/ml) and EP (ave. 119 cells/ml).

The abundances of Cyclotella meneghiniana v. plana and of its nominate variety C. meneghiniana decreased drastically from the river (averages: 1127 cells/ml, and 603 cells/ml, respectively) toward the lake (averages: 39 cells/ml, for the former species and 42 cells/ml, for the latter). Although the populations of these species in the edge of the plume and lake were relatively small, both C. meneghiniana v. plana and C. meneghiniana comprised a high portion of total phytoplankton at the middle plume station, especially at the surface, ca. 25.0 percent. The average populations at the MP station were: 456 cells/ml, for the former species, and 127 cells/ml, for the latter. In the river, at the surface, both species made up together 34.5 percent of the total.

Melosira granulata was much less abundant than the previous four species; an average of 153 cells/ml was found in the river, and of 43 cells/ml in the middle plume. The numbers found in the edge of the plume and lake ranged 1 to 7 cells/ml.

The maximum quantity of Stephanodiscus subtilis was found in the river, at the bottom (100 cells/ml). Rather numerous populations of this species ca. 40 to 53 cells/ml were present also at 1 and 6 meters depth in the middle plume and at the bottom in the lake. Quantities of 2 to 9 cells/ml were found in a few other collections from the PP (surface), MP (bottom) and EP (bottom) stations.

As in S. subtilis, irregular pulses of occurrence were observed in the case of Stephanodiscus tenuis. The average populations in the river were 169 cells/ml; however, in the middle plume there were only about 15 cells/ml. The maximum count, 222 cells/ml, was found at the surface in the edge of the plume while only ca. 6 cells/ml were noted at the bottom of the same station. Quantities found at 14 meters depth in the lake (116 cells/ml) were much higher than those found at the surface (34 cells/ml) and bottom (27 cells/ml).

A few other species, including Melosira granulata v. angustissima, M. varians, Cyclotella kützingiana and Stephanodiscus astrea, were found in maximum concentrations (58 to 110 cells/ml) at the bottom in the river. They were present at most of the remaining sampling depths in much smaller abundance (2 to 30 cells/ml).

At least 20 species of the Centrales were found at each of the MP, EP, and Lake stations. Six of these entities were absent from the river but comprised together a very high portion of the total diatoms, in the middle plume, edge of the plume and lake. They were usually found in largest abundance in the lake, with maximum populations at the bottom. Generally, their average counts were decreasing from the lake toward the middle plume, and usually, at each station, the populations of any of these species were higher in bottom waters than at the surface.

The counts of Stephanodiscus alpinus ranged from 133 cells/ml (at the surface of the EP station) to 417 and 430 cells/ml (at the bottom and 14 meters in the lake). The average populations in the lake (347 cells/ml) were higher than in the middle plume (239 cells/ml) and over twice as large as those in the edge of the plume (145 cells/ml). Among the six entities which were absent from the river, but abundant at stations MP, EP and Lake this species was usually found in the highest quantities and made up 5.93 percent to 12.34 percent of the total phytoplankton.

Stephanodiscus transilvanicus was found in similar average abundance in the middle plume and edge of the plume (ca. 75 cells/ml). The concentrations in the lake (ave. 155 cells/ml) were twice the size of those observed at stations MP and EP.

The maximum populations of two representatives of the genus Melosira, Melosira islandica (460 cells/ml) and M. italica subsp. subarctica (156 cells/ml), were found at the bottom in the lake. The minimum quantities, 64 cells/ml, for the former species, and 27 cells/ml, for the latter, were recorded from the surface in the middle plume.

Cyclotella ocellata was present in the lake in average numbers of 65 cells/ml. Smaller quantities were observed in the middle plume (ave. 39 cells/ml) and edge of the plume (ave. 23 cells/ml).

The counts of Cyclotella stelligera ranged from 3 cells/ml (at the bottom, station MP) to 57 cells/ml (at the surface, station EP).

Few other species of the Centrales were found in some collections, at times in rather high abundance. Thus Cyclotella michiganiana was very common at the surface in the river (50 cells/ml) and less common in the lake (20 cells/ml). It was absent from the edge of the plume, and ca. 7 cells/ml were observed in the middle plume. Cyclotella comta was present at the MP station in average quantities of 21 cells/ml. Smaller numbers (2 to 7 cells/ml) were noted in few collections from the other stations. The maximum quantities of Coscinodiscus subsalsa were observed at about 6 meters depth in the middle plume (30 cells/ml) and in the river (26 cells/ml). This entity was absent from the lake station, and only 2 cells/ml were found at the bottom in the edge of the plume.

The Pennales flora was extremely diverse: 232 species were identified in the April collections (Tables 2 and 4e). As in the previous months family Fragilariaceae (54 species) and genera Navicula (60 species) and Nitzschia (24 species) were represented by the highest variety of taxa. Total cell counts of the major genera are shown in Table 1.

Large populations of Fragilaria crotonensis ranging from 116 cells/ml (at the surface in the middle plume) to 368 cells/ml (surface, edge of plume) were found at the sampling depths of the MP, EP and Lake stations. Only an average of about 7 cells/ml was noted in the river.

The counts of F. capucina varied from 5 cells/ml (at the bottom in the river) to 48 cells/ml (at the bottom in the lake). The average numbers in the middle plume, edge of the plume and lake were similar, 31 to 39 cells/ml. This species was absent from the surface sample in the river. Varieties of F. capucina, F. capucina v. mesolepta and F. capucina v. lanceolata, were present at all stations in small abundance, only the former entity occurred in somewhat higher numbers in two samples from the river and middle plume.

About 17 other species contributed to the total quantities of the genus Fragilaria. Some of them, Fragilaria brevistriata and variety, F. brevistriata v. inflata, F. construens and varieties F. construens v. binodis, and F. construens v. pumila, F. pinnata, F. pinnata v. lancettula and F. vaucheriae v. capitellata, were usually common or very common in samples from the river and middle plume. The varieties of F. brevistriata, F. pinnata and F. vaucheriae v. truncata, were also common in the edge of the plume, especially at the bottom. Other species such as F. intermedia and its variety F. intermedia v. fallax were frequently found in the lake, mainly at 14 meters depth.

Average abundances of the genus Synedra decreased gradually from the lake (312 cells/ml) toward the river station (151 cells/ml). Among 25 members of this genus identified in April only Synedra ulna was found in large quantities, in all collections. This species made up over 90 percent of the total counts of Synedra in the river. Several species, either absent from the river, as S. ulna v. chaseana and S. filiformis, or present there in very small numbers, such as S. delicatissima v. angustissima, S. ulna v. danica, and Synedra sp.(vaucheriae v. fragilarioides), were found in large abundance in the middle plume, edge of the plume and the lake. Together with S. ulna they mostly contributed to the total quantities of the genus Synedra at the MP, EP and Lake stations. Another species, S. ostenfeldii, absent from the river, occurred in rather small numbers in the middle plume, but was common in the edge of the plume and lake. Synedra demerarae and

S. ulna v. spathulifera were present in most collections, but usually in small quantities. All other species of this genus occurred sporadically and in low abundance, only S. ulna v. claviceps and S. parasitica v. subconstricta were relatively common at the bottom in the middle plume.

Tabellaria fenestrata, representative of the genus Tabellaria was found at all sampling depths in the middle plume, edge of the plume and lake in quantities ranging from 115 cells/ml (at the bottom, station EP) to 256 cells/ml (at the bottom, station MP). In the river this entity was present only at the bottom (2 cels/ml). Small populations of T. flocculosa (3 to 7 cells/ml) were observed in the 6 meter sample from station MP and the 14 meter sample from the lake.

Genus Asterionella was mainly represented by A. formosa. Isolated pulses of A. formosa v. acaroides were noted at the surface in the middle plume and at the bottom in the lake. Also A. gracillima was relatively common at 14 meters depth in the lake. Average counts of the genus from the river (ca. 80 cells/ml) were about twice as high as those from any of the remaining stations (30 to 47 cells/ml).

Maximum concentrations of species belonging to the genus Diatoma were found in the lake (ave. 76 cells/ml). Minimum quantities (ave. 19 cells/ml) were observed in the middle plume. Abundances in the river and edge of the plume were similar (ave. 32 to 35 cells/ml). Diatoma tenue v. elongatum was present in all collections, with the highest numbers at the surface of the edge of the plume and at all sampling depths in the lake. Diatoma tenue v. pachycephala was common at the EP and Lake stations, but absent from the river and middle plume. Rather numerous populations of D. vulgaris were identified at the PP and MP stations, especially at 6 meters depth.

Members of the genus Navicula were present in large abundance in the river, mainly at the bottom (average at the station: 360 cells/ml). Smaller quantities, with concentrations decreasing with depth were found in the middle plume (average 86 cells/ml). Relatively very small counts were recorded from the EP (ave. 8 cells/ml) and Lake (ave. 13 cells/ml) stations. Though the algae of this genus were very

diverse (60 species) only several species were present in high or very high numbers, mainly in the river and middle plume. All of the remaining entities were rare or very rare and were usually found in only few samples.

Navicula decussis and a few varieties of N. cryptocepha and N. tripunctata were present in most collections. Among them only N. decussis, N. cryptocephala v. intermedia, N. tripunctata and N. tripunctata v. schizonemoides were common or very common in the river and middle plume. Common at the PP and MP but virtually absent from the EP and Lake stations were N. viridula and N. viridula v. linearis. Species such as N. gastrum and N. capitata were only occasionally common in samples from the river or middle plume. Others such as N. gregaria, N. integra, N. lanceolata and N. radiosa v. tenella, although found in most collections, occurred in higher numbers only in the river, especially at the bottom.

The highest count of the genus Nitzschia (193 cells/ml) was recorded from the bottom in the river, and the smallest (32 cells/ml) from the bottom at the EP station. The entity designated as Nitzschia sp. #2 was very common in all collections and mostly contributed to the total quantities of this genus. Present in most samples, however, in small numbers were taxa: Nitzschia sp #1, Nitzschia sp. #6, N. acuta, N. amphibia, N. dissipata and N. sigmoidea. Occasionally somewhat higher pulses of a few of these entities were observed at the surface in the edge of the plume (N. dissipata, Nitzschia sp. #6), in deeper water in the lake (N. dissipata, Nitzschia sp. #1 and also N. bacata) or river (N. amphibia). Two species, N. angustata v. acuta and N. linearis were common at the bottom in the river but rare at the surface, and practically absent from the middle plume, edge of the plume and the lake. About 13 other members of this genus, including N. commutata, N. acuminata, and N. interrupta, were found sporadically, in small abundance.

A total of 94 other species of the pennate diatoms derived mainly from the benthic community, were identified in this month's

collections. A majority of these entities were found sporadically and in low abundance. About 30 species occurred in relatively high numbers at the sampling depths in the river and middle plume. Most of them were members of the genera Achnanthes, Amphora, Cocconeis, Cymbella and Gomphonema.

Common or very common in samples from the river (especially from the bottom) and middle plume, but usually absent from the edge of the plume and lake (especially from the surface and 6 meters depth), were the following species:

Achnanthes lanceolata, its variety, A. lanceolata v. dubia and A. clevei; varieties of Amphora ovalis--A. ovalis v. pediculus, A. ovalis v. libyca, and A. ovalis v. gracilis; members of the genus Cocconeis--Cocconeis placentula, C. pediculus, and a solitary representative of the genus, Rhoicosphaenia curvata. Gomphonema olivaceum was present at all sampling depths, in particularly high quantities in the river, middle plume and bottom of the edge of the plume and the lake.

Some species were only sporadically common in collections from the river and middle plume. They were present in small quantities in the remaining samples from the same stations, and usually were absent from the edge of the plume and the lake. To this group belonged: members of the genus Achnanthes--A. hungarica, A. hauckiana, A. hauckiana v. rostrata, A. lauenburgiana and A. pinnata; species of the genus Amphora--A. ovalis and A. subcostulata; members of Cocconeis--C. diminuta, C. placentula v. euglypta, C. placentula v. lineata; representatives of the genera Cymbella and Gomphonema--Cymbella sinuata, C. ventricosa, C. turgida v. pseudogracilis (these entities were very common at the surface of the MP station), Gomphonema angustatum and its variety G. angustatum v. producta; few solitary representatives of different genera as Bacillaria paxillifer, Caloneis amphisbaena, Cymatopleura solea and Opephora martyi. All of the above species were usually common at the bottom in the river and/or the surface in the middle plume.

Two other species, Surirella angustata and Cymatopleura solea v. apiculata were present at all stations in small numbers. They were rather common at the surface of the edge of the plume, and the former entity was also common at 14 meters depth in the lake.

4. Chlorophyta

Identified taxa and counts of this group of phytoplankton and also of other major groups discussed below are presented in Table 3 (April 1969 data). Total counts of green algae ranged from 11 units/ml (at the bottom in the lake) to 73 units/ml (at the surface of the EP station).

The greens were mainly represented by Ankistrodesmus falcatus, a species found in all collections, except one, from the surface in the river. The largest population of this entity was noted at the surface of station EP (70 cells/ml), the smallest (7 cells/ml), at the surface in the middle plume and bottom in the lake. Populations of similar sizes (29 to 37 cells/ml) were observed at other sampling depths of stations MP and Lake.

Oocystis solitaria was present in rather high quantity (28 col/ml) at the bottom in the river. Much smaller numbers (1 to 6 col/ml) were found at three other sampling depths at stations PP, MP and EP.

Few species of genus Scenedesmus were observed in the river and middle plume. Among them only S. quadricauda was found in all collections (1 to 7 col/ml).

All the remaining members of the green algae, including Closteriopsis longissima, Cosmarium sp., Dictyospherium pulchellum, Oocystis borgei and Pediastrum duplex, were found occasionally, in small abundance (1 to 3 units/ml).

5. Cyanophyta

Blue-greens constituted a very small portion of the total phytoplankton. They were not found at the surface in the river, and the counts at the remaining sampling depths ranged from 2 units/ml (at the

bottom, station PP) to 13 units/ml (at 14 meters, in the lake). Oscillatoria spp., present at all stations (2 to 12 filaments/ml), and also Aphanocapsa spp. and Dactyloccopsis smithii noted in few samples (1 to 4 col/ml) were the only representatives of this group.

6. Chrysophyta

Dinobryon divergens was the only member of Chrysophyta found in April. The maximum populations, 62 and 49 cells/ml, were recorded from about 6 meters depth at stations MP and PP, respectively. The minimum quantities, 10 to 12 cells/ml, were found in bottom waters in the lake and the middle plume. This species was absent from the surface in the river.

7. Pyrrophyta

Maximum concentrations of Peridinium spp. (54 to 69 cells/ml) were observed at the bottom in the edge of the plume and lake. Smaller amounts (1 to 28) were found in few other samples. These phytoplankters were absent from the river and the surface of station MP.

8. Flagellates

Chlamydomonas sp., Cryptomonas sp., Euglena spp. and a group of undetermined flagellates comprised together between 3.61 percent and 19.39 percent of the total phytoplankton in April collections. The highest quantities of flagellates (average 421 cells/ml) were found in the lake. Average concentrations of similar sizes (ca. 388 cells/ml) were observed in the river and middle plume. Smaller abundances (ave. 284 cells/ml) were found in the edge of the plume.

Populations of Chlamydomonas ranged from 21 cells/ml at the surface in the river to 289 cells/ml at the surface in the lake.

The average concentrations of Cryptomonas decreased gradually from the river (69 cells/ml) toward the lake (27 cells/ml).

Maximum count of Euglena spp. (13 cells/ml) was found at the surface in the river. Smaller numbers (2 to 7 cells/ml) were observed at few other sampling depths of stations PP, MP and Lake.

A group of undetermined flagellates was found in highest amounts (ave. 215 cells/ml) in the lake. Quantities in the river (ave. 174 cells/ml) and edge of the plume (ave. 158 cells/ml) were similar and somewhat higher than in the middle plume (126 cells/ml).

F. May 29, 1969

1. Physical-Chemical Data

The river plume was turning slightly toward the north. The winds were mild, 9 mph, from the SSE. Figure 1f illustrates the location of the sampling stations.

The physical data are presented in Tables 5f(1) and 6ℓ. Surface water temperature decreased from 19°C in the river to 10.5°C in the edge of the plume and at the lake station which was located 5 km from shore. There was no vertical temperature difference in the river. At the remaining stations (MP, EP, LAKE) the surface readings were slightly higher than those at the bottom and intermediate depths, and much lower, at least 7.5°C, than in the river.

Secchi disc transparencies ranged from 0.7 m in the river, where the water was dirty, yellow-brown, to 4.5 m in the clear, yellowish-green lake water. The highest amount of surface light at Secchi depth, 3.2%, was noted at station PP, the lowest, 0.44%, at station EP (at 4 m).

Calculations indicated that the surface waters at station MP contained 20% of river water.

Table 5f(2) shows the average chemical results. Except for dissolved oxygen, which had the highest values (10.3 ppm) in the edge of the plume and lake, and pH with similar results (8.7 - 8.8) at all stations, the average values observed in the river were greater than at the remaining stations. Considerable reduction of these values was noted at station MP in comparison with PP, and a less pronounced decrease at the EP and Lake stations as compared with MP. Total alkalinity average results were higher at the edge of the plume than at the middle plume and lake.

Tables 6a-6k present the values of the eleven chemical parameters obtained at various depths of the May stations. Observation of these tables reveals similar patterns in the vertical distribution of values for most chemicals in the middle plume and edge of the plume on one hand, and at the river and lake stations on the other. In the mixing

water region (MP, EP) the values for most parameters at the surface, or at 5 meters depth, were higher than those at the bottom. In the river and lake the concentrations were either increasing with depth (e.g., silica, nitrate, carbon dioxide) or they were vertically uniform or nearly so (e.g., pH, oxygen, chloride, alkalinity). Different only in the river, from the lake, was the distribution of sulfate and turbidity; the surface values in the river were higher than those in bottom waters, while in the lake the concentrations were increasing with depth.

As during the previous months, particularly striking was the quick disappearance of phosphates from the river toward the lake. While in the river the values were high (ave. 39.4 ppb), only minute amounts of orthophosphate (0.2 to 3.8 ppb) were noted at the bottom of the middle plume, at 5 meters depth and bottom of the edge of the plume, and at all sampling depths in the lake. The values in top waters at MP and EP were somewhat higher (7.4 to 12.7 ppb).

2. Phytoplankton Data

Figure 7a illustrates the average counts of total phytoplankton and of major phytoplankton groups. The average quantities of total phytoplankton and diatoms decreased from the river toward the lake by a factor of three. For comparison Figure 7b shows the corresponding decrease of average values of nutrients and silica.

The two highest total phytoplankton cell counts, remarkably similar, were found at the surface of station MP, 6587 units/ml, and at the bottom in the river, 6524 units/ml. The smallest count, 1546 units/ml, was recorded from the surface in the lake. Within station MP (except at the surface), EP and LAKE, the population densities at various segments of the water columns were of similar sizes, particularly uniform were total diatoms concentrations in the lake, at the surface and bottom of station EP, and at the 5 meters depth and bottom of station MP.

3. Bacillariophyta

Diatoms comprised between 54.86% and 86.73% of total phytoplankton in the May collections. The maximum counts corresponded with the peaks of total phytoplankton, and were recorded from the bottom in the river (5658 cells/ml) and from the surface of station MP (5611 cells/ml). The minimum quantities were found in the lake, especially at the surface (1073 cells/ml). At stations PP, MP, and EP, centric diatoms dominated total diatoms populations. In the lake, pennate diatoms made up a higher portion of total diatoms than the Centrales. In general, the percent composition of the Centrales decreased, and of the Pennales increased from the river toward the lake. Diatoms, cell counts and the relative abundance of diatoms in total phytoplankton are presented in Tables 1 and 2.

Several species of the centric diatoms were very abundant in the river phytoplankton: Cyclotella meneghiniana v. plana, C. meneghiniana, Stephanodiscus subtilis, S. tenuis, S. hantzschii, S. minutus, Melosira granulata v. angustissima and M. granulata. They were usually found in a high abundance also in the river plume area, mainly at station MP. Few of them were common (C. meneghiniana v. plana, M. granulata) or abundant (S. hantzschii) in the lake, but in general, their average quantities decreased very sharply from the river toward the lake station. The average counts of these species in the river ranged from 98 to 1064 cells/ml, while in the lake 4 to 26 cells/ml. Only S. hantzschii was present at the lake station in large quantities, ave. 96 cells/ml. It was noted that in most cases, populations of any of these species at all four stations, and especially at MP and EP, were decreasing with depth. Among these phytoplankters few occurred in particularly large numbers, and dominated populations of the Centrales in the river.

Maximum quantities of Cyclotella meneghiniana v. plana (1338 cells/ml) and C. meneghiniana (889 cells/ml) were found at station PP, at the surface and bottom, respectively. Average abundance of the former entity in the middle plume (240 cells/ml)

and edge of the plume (176 cells/ml) decreased several fold in comparison with the river station (ave. 1064 cells/ml), and the amounts found in the lake (ave. 26 cells/ml) were relatively very small. The latter species was present in large quantities (ave. 170 cells/ml) also in top waters in the middle plume, but the counts from all other sampling depths at stations EP, LAKE and the bottom at MP ranged 1 to 15 cells/ml.

Average concentrations of Stephanodiscus subtilis in the river, 796 cells/ml, decreased to 217 cells/ml in the middle plume. Average populations of about 18 and 4 cells/ml were found at stations EP and Lake respectively.

Highest counts of S. tenuis were recorded from the surface of station MP (516 cells/ml) and bottom of PP (481 cells/ml). Quantities about twice smaller were found at the surface in the river. Populations at the edge of the plume (ave. 15 cells/ml) and lake (ave. 11 cells/ml) were as small as those of the two former species observed at the same stations.

S. hantzschii comprised a high portion of total phytoplankton at all four stations, especially in the upper segments of the water columns (ave. 6 to 14%). Largest abundance was observed at the surface in the middle plume (663 cells/ml). Average numbers in the river and middle plume (321 to 369 cells/ml) were higher than at station EP (259 cells/ml) and Lake (96 cells/ml).

Somewhat less abundant in the river were: S. minutus (ave. 159 cells/ml), Melosira granulata v. angustissima (ave. 201 cells/ml) and M. granulata (ave. 98 cells/ml). Identical populations of the first entity (ave. 39 – 42 cells/ml) were found at stations MP and EP, and smaller (ave. 14 cells/ml) in the lake. Average quantities of the two latter species in the middle plume were very much alike (about 108 cells/ml). Both species were present in the lake in a much lower abundance (ave. 24 cells/ml for M. granulata and ave. 8 cells/ml for M. granulata v. angustissima).

Another species, Stephanodiscus alpinus, was common at all stations, with maximum numbers (124 cells/ml) at the bottom in the edge of the plume, and minimum (ca. 16 cells/ml) at the surface of stations MP and LAKE. Average populations of this entity in the river and lake were of the same density (ca. 42 cells/ml) and smaller than at MP (ave. 61 cells/ml) and EP (ave. 89 cells/ml).

Several species of the centric diatoms were absent from the river, but were common and sporadically abundant in the middle plume, edge of the plume and lake. Their highest quantities were usually found at stations MP and EP. It should be noted here that while at the sampling depths in the river plume area (MP, EP) the dominant species of the Centrales were usualy the same as in the river (C. meneghiniana v. plana, C. meneghiniana, S. hantzschii), at the lake station, the Centrales were mainly represented by Stephanodiscus binderanus, Rhizosolenia gracilis and R. eriensis, entities not found in the river, as well as by S. hantzschii and S. alpinus, which were present in the river.

Among the species found only at stations MP, EP and LAKE, the most abundant one was S. binderanus, with maximum concentrations at the surface in the middle plume (593 cells/ml), and minimum numbers (24 to 39 cells/ml) at 5 meters depth and surface of stations MP and EP. The average populations of this species in the edge of the plume (129 cells/ml) were twice smaller than in the middle plume (267 cells/ml), and those at the lake station (61 cells/ml) were twice smaller than at EP.

S. transilvanicus was very common (42 cells/ml) at 1 and 5 meters depths in the middle plume. Smaller counts (2 to 25 cells/ml) were found at all other sampling depths at stations MP, EP, and Lake.

Both Melosira islandica and M. italica subsp. subarctica were found in similar average densities (17 to 23 cells/ml) at all three stations. The former entity was observed also in the surface collection from the river (3 cells/ml).

Rhizosolenia gracilis and R. eriensis were present at the surface of station MP, at 5 meters and the bottom of station EP, and at all sampling depths in the lake. Highest total concentrations of both species (ave. 65 to 100 cells/ml) were noted at the surface and 10 meters depth in the lake and at the surface in the middle plume. Smaller quantities (4 to 35 cells/ml) were found in the bottom waters at EP and Lake.

Isolated high counts of Melosira granulata v. spiralis (258 cells/ml) and Cyclotella pseudostelligera (154 cells/ml) were observed at the surface in the middle plume. The former species was also present in a few samples from EP and LAKE (6 to 32 cells/ml). The latter was found in most other collections (2 to 20 cells/ml). Another species, Cyclotella ocellata was absent from the river but present in average densities (ca. 14 cells/ml) at MP, EP and Lake. Few other centric diatoms were sporadically very common in this month's collections, including those from the river.

Highest counts of C. comta (105 cells/ml) and C. kützingiana (35 cells/ml) were found at the surface in the river. Quantities of both species, about half the size of those at the surface, were observed at the bottom of the same station. Both entities were present in most samples from the other stations (1 to 19 cells/ml).

Melosira varians occurred in high quantities at the surface in the middle plume (140 cells/ml) and the bottom in the river (111 cells/ml); it was absent from the surface in the river and lake. Counts at the remaining sampling depths of stations MP and EP ranged from 4 to 18 cells/ml.

Cyclotella stelligera was present in the river in an average abundance of 20 cells/ml. The maximum count, 86 cells/ml, was from the surface of station MP. Numbers in a few other collections from the middle plume and lake were much smaller (1 to 9 cells/ml).

Coscinodiscus subsalsa was rather common (15 cells/ml) in only the sample from the surface in the river.

Pennales in May were represented by 226 taxa, the majority of which belonged to the family Fragilariaceae (59 taxa), the genera Navicula (52 taxa), Nitzschia (25 taxa) and Achnanthes (17 taxa), (Tables 2 and 4f). Except for the members of the genus Achnanthes, these algae contributed largely to the numerical abundance of the pennate diatoms (Table 1).

Pennales were found in similar average densities at the river station (914 cells/ml) and in the middle plume (980 cells/ml). Concentrations in the edge of the plume (ave. 758 cells/ml) and lake (ave. 734 cells/ml) were almost identical. The highest count (1486 cells/ml) and the lowest (538 cells/ml) were reported from the same station in the middle plume, from the surface and 5 meters depths respectively.

Maximum total quantities of species belonging to the genera Fragilaria and Diatoma were found either at stations MP, EP or in the lake. Minimum quantities were observed in the river.

The highest populations of F. crotonensis ranging from 105 to 128 cells/ml, were observed at the surface and bottom in the middle plume, and at the surface in the edge of the plume. The average quantities decreased slightly from station MP (99 cells/ml) toward the lake (60 cells/ml). Only ca. 9 cells/ml were noted at the surface and bottom in the river.

F. capucina was found in largest abundance at the bottom in the lake (148 cells/ml). Counts ranging from 32 to 115 cells/ml were recorded from all other sampling depths except these in the river, where the average concentration of this entity was about 17 cells/ml. F. capucina v. mesolepta was relatively common in the middle plume and lake, especially in the middle segments of the water columns.

Among 19 other members of the genus Fragilaria, few, F. brevistriata, F. vaucheriae v. truncata and Fragilaria sp. #6 were common at all sampling depths of stations PP, MP and in the surface waters at station EP. They were practically absent from the lake.

Few varieties of F. construens were identified from collections from the river and the river plume area (MP, EP). The nominate variety, F. construens was common at station MP and in surface waters in the river and edge of the plume. Common at MP was also F. construens v. binodis.

Rather common occasionally in samples from the river and middle plume were: F. pinnata, F. pinnata v. lancettula and F. intermedia. Fragilaria intermedia v. fallax occurred only in the middle plume, and was common at all sampling depths.

Members of the genus Diatoma were found in similar average amounts (ca. 52 cells/ml) at stations MP and EP. Somewhat smaller quantities (ave. 41 cells/ml) were present in the lake, and still smaller (ave. 25 cells/ml) in the river. Diatoma tenue v. elongatum and D. tenue v. pachycephala were absent from the river, but made up the majority of total numbers of Diatoma in the middle plume, edge of the plume and lake. In the river, the genus was represented by D. vulgaris, D. tenue and D. ehrenbergii. Diatoma vulgaris was found in a higher abundance than the two latter entities, it was also relatively common in the middle plume and rather rare at station EP.

Highest quantities of the genus Synedra (ca. 227 to 268 cells/ml) were found at 10 meters depth in the lake, at the surface in the middle plume, and at the bottom in the river. The average abundances decreased somewhat from the lake station (193 cells/ml) toward the river (ave. 150 cells/ml).

Synedra delicatissima v. angustissima was common at all sampling stations, with concentrations increasing with depth. Synedra ulna was common in the river, and in top waters at stations MP, EP and in the lake. Very common in the middle plume, edge of the plume and lake, and rare in the river, were S. ulna v. chaseana and S. ulna v. danica. Somewhat less abundant at the same stations were Synedra sp. (vaucheriae v. fragilarioides) and S. filiformis. A variety of the latter entity, S. filiformis v. exilis, was present in most collections,

usually in low abundance, however, it was very common at the bottom in the river, in contrast to the nominate variety, which was found there in only small numbers. Common at the surface and bottom in the river was S. acus. It was also present in few samples from the other stations, in much smaller quantities. Few other species were found rather commonly in the river collections, either from the bottom (S. fasciculata, S. ulna v. contracta and S. ulna v. constricta) or from the surface (S. ulna v. claviceps and S. ulna v. spathulifera). They were usually rare at stations MP and EP, except for the latter species which was present in relatively high numbers at the 5 meter depth and bottom in the middle plume. Other members of this genus, as S. parasitica and its variety S. parasitica v. subconstricta, S. demerarae and S. delicatissima, were rare in samples either from the river, middle plume or edge of the plume. One more species, S. ostenfeldii was quite common in the upper segments of the water columns at stations EP and Lake.

Tabellaria fenestrata was absent from the river. Populations of this species at stations MP, EP and in the lake were generally increasing with depth. The highest count, 319 cells/ml was found at the bottom in the lake, the smallest (100 cells/ml) at the 5 meter depth in the middle plume. The average quantities at all three stations were remarkably similar (198 - 207 cells/ml). Another representative of this genus, T. flocculosa was rather common (11 to 31 cells/ml) at the bottom of station EP and at all sampling depths in the lake. Lower abundance (4 to 7 cells/ml) was observed in the middle plume.

Unlike the genera of the pennate diatoms discussed above, whose average abundances decreased more or less gradually from the lake toward the river, the average quantities of the genera Asterionella, Navicula and Nitzschia decreased rather sharply from the river or middle plume toward the lake.

The highest count of Asterionella, 344 cells/ml, was found at the bottom in the river, the smallest, ca. 18 cells/ml, at the bottom in the middle plume and at the surface in the lake. The average

concentrations in the river were 270 cells/ml, in the middle plume 71 cells/ml, and at the lake station only 33 cells /ml.

A. formosa was present in all collections, and made up the majority of the total numbers of this genus. A. bleakeleyi was absent from few collections, however it was very common in the river, at 5 meters depth of station MP, and 10 meters depth in the lake. A. gracillima occurred rather abundantly at the bottom in the river and the surface of station MP, and A. formosa v. acaroides was identified in only one sample from the 5 meter depth at station MP.

Average abundance of the genus Navicula in the river was 161 cells/ml. Equally large quantities, 151 cells/ml, were found at the surface in the middle plume. Counts at all other sampling depths ranged from 1 to 22 cells/ml. An average of ca. 3 cells/ml was recorded from the lake station.

N. tripunctata and its variety N. tripunctata v. schizonemoides were very common in the river, and present in lower abundance in the middle plume and in top waters at the edge of the plume. Another variety, N. tripunctata v. cuneata was rather common at station PP, but was rare at MP and EP. Almost equally abundant as N. tripunctata in collections from stations PP, MP, and EP, was N. decussis. All four species were practically absent from the lake station and the bottom of station EP. Navicula gregaria, N. capitata, N. cryptocephala and its variety, N. cryptocephala v. intermedia were found commonly in the river, especially in bottom waters, and at the surface of station MP. The last entity was present in most samples, except those from the lake, but usually in very small numbers. Very common in the river and rare at MP and EP was N. lanceolata. Somewhat less common in the river, and absent from the other stations was N. radiosa v. tenella.

Several species, N. gastrum, N. heufleri, N. viridula, N. viridula v. avenacea and N. pupula were present in most collections from stations PP, MP, and EP, usually in low numbers. Only occasionally they were found in rather high quantities, especially at the surface in the river.

All the remaining members of this genus identified in May, including varieties of N. capitata and N. pupula, N. reinhardtii, N. elginensis, N. integra, N. latens and others, were found sporadically, and in small amounts.

Maximum abundance of the genus Nitzschia, 243 cells/ml, was observed at the surface in the middle plume. The average quantities in the river (125 cells/ml), were lower than at station MP (191 cells/ml), but much higher than at EP (86 cells/ml) and Lake (33 cells/ml). Total concentrations of Nitzschia throughout the water columns within each station, MP (except surface), EP and LAKE, were remarkably similar.

The entity designated as Nitzschia sp #2 was very common at most sampling depths, particularly in the surface waters at MP, EP and LAKE. It was much less abundant in the river than at the other stations. Absent from the surface in the river, but common at the bottom, common in the middle plume, edge of the plume, and present in smaller numbers in the lake was N. acicularis. Two other entities, N. bacata and Nitzschia sp. #1,were absent from the river and present in all other collections, often in high abundance. Nitzschia amphibia was found at stations PP, MP and EP, with maximum numbers in the river. Nitzschia dissipata occurred in relatively high quantities in the river and at the surface of station MP. Its variety, N. dissipata v. media was much less common in the river. Nitzschia sp #6 and N. palea were common at the bottom at station PP, and present in higher numbers at the surface in the middle plume. Common at the bottom in the river were N. linearis and N. hungarica. The latter species was also common in the bottom waters in the middle plume. Both entities were rare in few other collections from PP, MP and EP. Most of the remaining representatives of this genus, even if present in most collections (N. recta), were found in very low quantities.

Species belonging to such genera as Achnanthes, Amphora, Cocconeis, Cymbella, Gomphonema and others (represented usually

by few species), showed similar patterns of distribution to those observed in the previous months. Generally they were found in largest abundance in the river, in smaller quantities in the middle plume and edge of the plume, and were rare in the lake.

In most cases very common in the river, and somewhat less abundant at MP and in top waters at station EP were: Achnanthes lanceolata v. dubia, A. lanceolata, A. clevei, Amphora ovalis v. pediculus, Cocconeis placentula, C. placentula v. euglypta, Rhoicosphenia curvata and Gomphonema olivaceum. These entities were rare in some collections from the lake.

Somewhat less common in the river and middle plume, found in higher quantities in bottom waters, and absent from the lake were: Cocconeis pediculus, C. thumensis, and Opephora martyi. Cymbella ventricosa was also common in the river and at MP, especially at the surface.

Common or very common in the river and most of the time rare at stations MP and EP were: Amphora ovalis, A. subcostulata and Cocconeis placentula v. lineata.

Several species such as Achnanthes hauckiana v. rostrata, A. hungarica, A. lauenburgiana, Amphora ovalis v. gracilis, Amphipleura pellucida, Surirella angustata and Bacillaria paxillifer were only sporadically common either in the river, the mixing water region or in the lake.

4. Chlorophyta

Green algae comprised between 3.08% and 9.14% of total phytoplankton (Table 3). The average abundances decreased from the river toward the lake. The highest total count, 353 units/ml, was found at the surface in the river, and the lowest, 47 units/ml, at the surface in the lake.

Most abundant and present in all samples were Ankistrodesmus falcatus (maximum ca. 97 cells/ml, at the surface and 5 meters, station MP) and Dictyospherium pulchellum (max. ca. 79 colonies/ml,

at the surface and bottom in the river). The smallest quantities of both species were found in the lake (33 cells/ml--for the former species, and 1 col/ml--for the latter).

Among 15 species of genus Scenedesmus included in counts, only S. abundans and S. quadricauda were found in practically all samples. Their highest numbers, 27 to 61 col/ml were found in the river, especially at the surface. Lowest quantities (1 to 7 col/ml) were observed in the lake and in deeper waters at stations MP and EP. Three other species of Scenedesmus, S. dimorphus, S. incrassatulus and S. opoliensis, were present in the river, middle plume and at the surface of station EP and bottom in the lake. Their total counts ranged from 0.6 col/ml (bottom, lake) to ca. 17 col/ml (river). Other mmembers of this genus were present sporadically at stations MP, EP and in the lake, in low abundance (1 to 6 col/ml).

The genus Oocystis was represented mainly by O. solitaria, found in maximum quantities (17 to 44 col/ml) in the surface waters in the river, middle plume and edge of the plume. Another species, O. borgei, was present at all stations in small amounts (1 to 2 col/ml).

Coelastrum sphaericum was very common (51 col/ml) at the surface in the middle plume, and less abundant (1 to 11 col/ml) at other sampling depths at stations PP, MP, EP and at the surface in the lake.

Actinastrum hantzschii was present (1 to 11 cells/ml) at stations PP, MP and EP, and Quadrigula lacustris (1 to 8 col/ml) at stations MP, EP and in the lake.

All the remaining greens were found sporadically, usually in small numbers (1 to 8 units/ml).

5. Cyanophyta

This group made up a small portion of total phytoplankton, at most 1.23 percent.

Oscillatoria spp. were found at all sampling depths, with highest concentrations, ca. 20 fil/ml, at the surface and bottom

in the middle plume, 5 meters depth in the edge of the plume, and 10 meters depth at the lake station. Populations present at all other sampling depths ranged 7 to 11 fil/ml.

A higher count of Aphanizomenon flos-aquae (20 fil/ml) was observed at 5 meters depth of station MP. Smaller numbers(6 fil/ml) were found in bottom waters at the same station and at the surface of station EP (2 fil/ml).

Aphanocapsa spp., Chrococcus minutus and Phormidium spp. (ca. 2 units/ml) were noted in solitary samples either from station MP, EP or Lake.

6. Chrysophyta

Dinobryon divergens was found in all collections but one, the bottom in the edge of the plume. Highest counts were found at the surface (117 cells/ml) and bottom (81 cells/ml) in the river. Lowest abundance (2 - 8 cells/ml) was observed in the lake and in deeper water of stations MP and EP.

Mallomonas spp. were absent from the river but were common (17 - 46 cells/ml) in most samples from the other stations.

Tribonema sp. was noted in deeper water at MP and EP (ca. 4 cells/ml).

7. Pyrrophyta

Peridinium spp. were found in numbers ranging from 4 to 37 cells/ml. Maximum concentrations (25 - 37 cells/ml) were found in deeper water at stations MP, EP and in the Lake. Minimum quantities (4 - 6 cells/ml) were observed at the surface in the river and middle plume.

8. Flagellates

Percent composition of flagellates in the total phytoplankton varied from 7.36 percent (bottom, river) to 36.65 percent (5 meters,

EP). Maximum abundance (914 cells/ml) was found at 5 meters depth in the edge of the plume. Lowest count (334 cells/ml) was recorded from 10 meters depth in the lake.

Average populations of Chlamydomonas increased significantly from the river (19 cells/ml) toward the edge of the plume (447 cells/ml). In the lake (ave. 256 cells/ml) they were of similar size as those observed in the middle plume (ave. 283 cells/ml). At each station, higher concentrations of these organisms were found in deeper water.

Abundance of Cryptomonas decreased from the river (ave. 327 cells/ml) toward the lake (ave. 66 cells/ml).

A few entities included in total counts of undetermined flagellates were found in large abundance at stations PP, MP and in the lake. The maximum concentrations (247 cells/ml) were recorded from the surface in the middle plume, the minimum (37 cells/ml) from the bottom in the edge of the plume. Highest counts at each station were found in surface waters.

Euglena spp., Pteromonas sp. and Phacus sp. occurred at few sampling depths, in small quantities (2 – 8 cells/ml).

G. June 23, 1969

1. Physical-Chemical Data

For about one week preceding the sampling day, and at the start of sampling, the winds were from the southeast onto the lake. The river plume was turning slightly toward the north. During the sampling hours, the winds changed direction 360 degrees to the northwest, and in entering the lake the plume was forming a bulge (Fig. 1g).

Table 5g(1) shows the physical data. Surface water temperature decreased from 18.8°C in the river to 13.1°C at the lake station, located 2.7 km west from the piers. In the river the vertical temperature readings were uniform. Temperature gradients were observed at stations MP, EP and in the lake, where the bottom readings were lower (1.9 to 4.2°C) than those at the surface (Table 6*l*).

Secchi disc depth increased gradually from 0.7 m in the river, to 3.5 m in the lake. The highest amount of surface light (15 percent) at disc depth, was noted in the river.

In the mixing water area, at stations MP and EP, 27 percent and 20 percent content of river water was detected at the surface.

Table 5g(2) shows the average chemical results. As during the fall and spring sampling periods, the highest values for all parameters, except dissolved oxygen (max. 10.5 ppm at EP) and pH (maxima ca. 8.78 at both PP and Lake stations), were found in the river, and the lowest, in the lake. Also, as was observed during the previous months, the values from the middle plume showed a drastic decrease in comparison with the river concentrations. Total alkalinity, sulfate and chloride decreased on the average by a factor of two, orthophosphate by a factor of twelve, silica more than five times, and nitrate more than three times. However, the average values of nutrients, silica, and alkalinity found at the edge of the plume were somewhat higher than those from the middle plume, due to either higher surface (phosphate, alkalinity) or bottom results (silica, nitrate).

Examination of Tables 6a-6k (June, 1969 data) reveals rather pronounced differences within water columns at any one station between the surface and the bottom concentrations of individual chemicals. Only oxygen content, pH, carbon dioxide and alkalinity showed, in most cases, little or no variation in the vertical distribution of values. All the remaining parameters at the river and lake stations, except turbidity, in the river, and except chloride and phosphate in the lake, had surface concentrations lower than those at the bottom. Conversely, in the middle plume and edge of the plume, the chemical values were decreasing with depth.

Especially noteworthy were the results for silica and orthophosphate. Very low silica concentrations were found at the bottom in the middle plume (0.47 ppm) and at the surface in the lake (0.38 ppm). Complete depletion of phosphate was observed in bottom waters of both EP and Lake stations, and only minute concentrations (0.9 to 1.4 ppb) were found at the surface in the lake and at 5 meters depth and bottom of station MP.

2. Phytoplankton Data

Highest counts of total phytoplankton were recorded from the river station with the maximum of 12619 units/ml at the surface. Lowest counts were found in the lake with the minimum of 2147 units/ml at the bottom. Numbers in the middle plume were on the average 2.6 times smaller compared with those in the river (ave. at PP 11679 units/ml). In the edge of the plume, the average concentrations (4303 units/ml) were only slightly smaller than in the middle plume. The average counts from the lake station (2334 units/ml) were five times smaller in comparison with the river counts. At each station, total populations in surface waters were higher than those at the bottom. Figure 8a illustrates the drastic reduction of total phytoplankton, diatoms, greens and flagellates from the river toward the lake. For comparison, Fig. 8b shows the average nutrients and silica values obtained at the same stations.

3. Bacillariophyta

In the June 1969 samples, diatoms constituted between 74.49 percent and 92.94 percent of total phytoplankton. Diatom maxima and minima corresponded with those of total phytoplankton; the highest count, 9274 cells/ml, was recorded from the surface in the river, and the lowest, 1851 cells/ml, from the bottom at the lake station. In the river, and in top waters at stations MP and EP, centric diatoms comparised a higher portion of the total diatom numbers than the Pennales. In the bottom waters at MP and EP and in the lake, the relative abundance of Pennales was higher (or about identical, bottom EP) than of the Centrales. Diatom cell counts and the relative abundance of diatoms in the total phytoplankton are shown in Tables 1 and 2.

Among 15 species of the centric diatoms identified in collections from the river, most were found in very high or high abundance. Even the least numerous species were present in relatively large quantities (ca. 25 to 70 cells/ml). In general their average populations were decreasing from the river toward the lake. Particularly drastic decrease was observed from the river toward the middle plume. At MP and EP the populations were often of similar sizes, although usually they were lower at the EP. Sharp decrease was noted again from the edge of the plume toward the lake. In most cases, at stations PP, MP, EP and to a lesser degree in the lake, higher concentrations of any of these species were found in surface waters.

As during the fall months, *Cyclotella meneghiniana* v. *plana*, *Melosira granulata* v. *angustissima* and *M. granulata* dominated by far the total diatom quantities in the river. Maximum counts of these species were respectively: 3077 and 3041 cells/ml, found at the surface, and 828 cells/ml,. at the bottom. Minimum numbers of the two latter entities, at the surface in the lake were rather high, 104 and 75 cells/ml, while those of *C. meneghiniana* v. *plana* were much smaller: 11 cells/ml at the surface, (ave. 19 cells/ml). *M. granulata* v. *angustissima* was present in much higher abundance at station MP (ave. 1009 cells/ml) and EP (ave. 948 cells/ml) than the other two

species. Average quantities of C. meneghiniana v. plana and M. granulata at MP were similar, 286 and 294 cells/ml. At EP the numbers were: 215 cells/ml for the former species, and 394 cells/ml for the latter.

Several other species, although abundant in the river, were found in much smaller quantities than the three above phytoplankters.

Counts of Stephanodiscus hantzschii ranged from 236 cells/ml in bottom waters at station PP to 14 cells/ml at the bottom in the lake. Rather high numbers were found at MP (ave. 91 cells ml) and EP (ave. 80 cells/ml).

Average populations in the river of Stephanodiscus tenuis, S. subtilis, S. astrea, S. minutus, Melosira varians and Cyclotella meneghiniana varied from 57 to 289 cells/ml. Their average concentrations in the mixing water area, at stations MP and EP, were much smaller (11 to 30 cells/ml). Still lower abundance of these species was observed at the lake station (ave. 1 to 9 cells/ml).

Common in the river (ave. 30 to 46 cells/ml) and present in small numbers at stations MP, EP and the lake (ave. approximately 1 to 5 cells/ml) were also Cyclotella comta, C. kützingiana and Coscinodiscus subsalsa.

Eight species of the Centrales were absent from the river, but present at the other stations; few of them, Stephanodiscus alpinus, S. binderanus and Melosira islandica, occurred in large abundance in the middle plume, edge of the plume and in the lake. Their highest populations were found either at the MP or EP. In general, the numbers of both S. alpinus and S. binderanus were drastically increasing with depth. Only at the lake station S. binderanus was present in higher quantities at the surface than at the bottom. Counts of S. alpinus varied from ca. 51 cells/ml in surface waters at stations EP and Lake, to ca. 177 cells/ml at 5 meters depth and bottom in the middle plume. Concentrations of S. binderanus ranged from 8 cells/ml, at the bottom in the lake, to 262 cells/ml at the bottom in the edge of the plume. Average quantities of M. islandica decreased gradually from MP (ave. 114 cells/ml) toward the lake (ave. 86 cells/ml).

Another species, M. italica subsp. subarctica, was only found in the edge of the plume (ave. 111 cells/ml) and in the lake (ave. 1.5 cells/ml).

S. transilvanicus, C. ocellata, C. michiganiana and C. pseudostelligera were present at stations MP, EP and in the lake in low abundance, usually 1 to 10 cells/ml. Highest counts, 17 and 22 cells/ml, were noted for C. ocellata (at 5m, PM) and S. transilvanicus (bottom, lake).

In June the Pennales were represented by 260 taxa. As in the previous months, the highest numbers of species belonged to family Fragilariacae (58) and genera Navicula (69), Nitzschia (25) and Achnanthes (20), (Tables 2 and 4g).

Highest total quantities of the genera Fragilaria, Tabellaria and Diatoma were found either in the middle plume, the edge of the plume or in the lake. The numbers found in the river were often much smaller and Tabellaria was absent from station PP. Few species of these genera were present in particularly large abundance.

Maximum populations of F. crotonensis were observed in the edge of the plume (ave. 335 cells/ml). Average concentrations in the middle plume and lake were nearly identical (241 to 248 cells/ml) and higher than in the river (ave. 189 cells/ml).

Highest numbers of F. capucina (354 cells/ml) were found at the bottom of station MP, however, the average quantities at this station (294 cells/ml) were similar to those at EP and in the lake (ca. 262 cells/ml). An average of about 11 cells/ml was noted at station PP. Counts of this species included also related entities, F. capucina v. mesolepta and F. capucina v. lanceolata. Both varieties, especially the latter, were common at MP, EP and in the lake.

Other members of the genus Fragilaria, F. brevistriata, F. construens, F. construens v. binodis and F. pinnata, were present at stations PP, MP and EP, and were practically absent from the lake. All were common in the river, and at the surface and 5 meters depth

in the middle plume. They were found in particularly large quantities in the bottom waters at the PP. Common at the bottom in the river, but usually rare at other sampling depths, were varieties of some of the former species as F. brevistriata v. inflata and F. pinnata v. lancettula, and also F. leptostauron and F. leptostauron v. dubia, F. intermedia and F. vaucheriae v. truncata.

All the remaining species of this genus found in the June collections were rare and only occasionally a few of them occurred in somewhat higher numbers.

Tabellaria fenestrata, representative of the genus Tabellaria, was found only at stations MP, EP and Lake, where it comprised 4.04 to 19.56 percent of the total phytoplankton. Concentrations of this entity were uniform vertically in the lake, and also in the middle plume, except at the bottom, where much larger populations (ca. 200 cells/ml more) were found. Average counts from the lake (404 cells/ml) and station MP (425 cells/ml) were similar, and higher than those from EP (267 cells/ml). Another species of this genus, T. flocculosa, was rather common at the same stations. Maximum numbers (ca. 40 cells/ml) were found at 5 meters depth in the middle plume.

At each station, except in the lake, total populations of the genus Diatoma increased with depth. The highest concentrations of similar sizes were found at the bottom at station MP, (356 cells/ml) and at the surface in the lake (323 cells/ml). Average numbers in the edge of the plume and lake were almost identical, (ca. 210 cells/ml) and lower than in the middle plume (274 cells/ml). Smallest quantities were observed in the river (ave. 31 cells/ml). Diatoma tenue, D. tenue v. elongatum and D. tenue v. pachycephala were absent from the river, but present at all other sampling depths. The two latter species, and first of all D. tenue v. elongatum, made up the majority of total numbers of this genus. The nominate variety, D. tenue, was the least abundant entity. Diatoma vulgaris was practically the only member of the genus found in the river. It was also common at the surface and at 5 meters at station MP. Also, D. ehrenbergii and D. vulgaris v. brevis were identified in few samples.

The highest total count of the genus Synedra (148 cells/ml) was recorded from the surface in the lake. Concentrations at all other sampling depths at PP, MP, EP and Lake, were only slightly smaller than the maximum quantity, and strikingly uniform (about 80 to 113 cells/ml).

Synedra ulna made up over 90 percent of the total numbers of this genus in the river. It was also common at the surface in the middle plume, and in the edge of the plume. Relatively common in the river and usually very rare at the other stations was S. ulna v. spathulifera. Two other species, S. parasitica and S. ulna v. claviceps were found rather commonly in the bottom waters at station PP. About 14 other representatives of this genus present in the river, occurred in very small quantities.

S. ulna v. chaseana was abundant in the middle plume, edge of the plume and lake, and very rare in the river. Common, or relatively common in most samples from the same stations (except PP), were S. ulna v. danica and Synedra sp. (vaucheriae v. fragilarioides). Synedra delicatissima v. angustissima was present in rather high numbers in deeper water at MP, and in smaller abundance in the lake. All other members of Synedra, even when present in most collections (S. parasitica v. subconstricta, S. ulna v. contracta), were usually found in small quantities.

Highest abundances of the genera Asterionella, Navicula and Nitzschia were observed in the river. The average quantities decreased drastically from the river toward the lake.

Total counts of Asterionella ranged from 7 cells/ml, at the surface in the edge of the plume, to 214 cells/ml at the surface in the river. Average populations at station MP (61 cells ml) were over three times smaller than those in the river. Populations at EP (ave. 19 cells/ml) and in the lake (ave. 29 cells/ml) were of similar sizes. Except at station EP, total numbers were decreasing with depth. This genus was represented by A. formosa and A. bleakeleyi. The latter entity occurred in higher quantities than the former one, in surface

waters at PP and MP. Asterionella formosa was more abundant at all other sampling depths. Common at the bottom in the river, but absent from other stations were also A. gracillima and A. formosa v. acaroides.

Members of the genus Navicula were found in the river in average numbers of 290 cells/ml. Much smaller quantities were observed at stations MP (ave. 39 cells/ml), EP (ave. 23 cells/ml) and Lake (ave. 5 cells/ml). Total populations were usually slightly decreasing with depth.

Navicula decussis, N. tripunctata and N. viridula were found in abundance in the river, and usually in smaller quantities, decreasing toward the lake, at the other stations. Navicula viridula was absent from the lake station. Absent from, or rare in the lake, and common or relatively common in the river, and often also in the upper parts of the water columns at stations MP and EP were: N. tripunctata v. schizonemoides, N. capitata, N. cryptocephala v. intermedia, N. gastrum and N. lanceolata. Navicula latens was very rare in the river, but common at most other sampling depths. Occasionally quite common in collections from PP, MP or EP were: N. heufleri, N. paludosa and Navicula sp. (pygmaea v. producta). All of the remaining species of this genus were found in very small numbers.

Average counts of the genus Nitzschia ranged from 27 cells/ml in the lake to 221 cells/ml, in the river.

Common in the river were: N. hungarica, Nitzschia sp.# 2, N. amphibia and N. tryblionella v. levidensis. The first two entities were common also at stations MP and EP, especially at the surface. The two latter ones were rare at few other sampling depths. Nitzschia sp.# 1 was common in all samples from MP, EP and Lake, especially in those from deeper water. A very similar pattern of distribution was observed for N. bacata, with the exception that this species was not found at the bottom at the lake station. About 19 other members of Nitzschia were found in low abundance. Among them, more frequently noted were N. recta, N. linearis and N. fonticola.

Large numbers of taxa, about 108, belonged to 27 various genera. The majority of these entities were found only occasionally in very

small quantities. Several were common, and at times abundant, mainly in the river. Their numbers were usually decreasing from station PP toward the lake.

Common, or very common in most samples from the river, middle plume and the edge of the plume, and rare in the lake collections were: Achnanthes lanceolata v. dubia, Gomphonema olivaceum, Rhoicosphaenia curvata (these three species were abundant in the river), A. lanceolata, Amphora ovalis v. pediculus, A. ovalis, Cocconeis placentula and C. placentula v. euglypta.

Common in the river, and only sporadically common at other sampling depths at MP and EP were: Achnanthes clevei, Gomphonema angustatum v. producta, Cymbella sinuata, C. turgida v. pseudogracilis, Cocconeis pediculus and C. diminuta.

Few species were common in the river, either at the surface (Achnanthes conspicua, Cocconeis placentula v. lineata), or at the bottom (Achnanthes hauckiana v. rostrata, Meridion circulare, Opephora martyi). They were rare at MP, EP or Lake.

Occasionally rather common at stations MP, EP and Lake were: Cymatopleura solea, C. solea v. apiculata, Achnanthes lauenburgiana, Gomphonema angustatum, Cocconeis thumensis, Amphora neglecta and A. ovalis v. libyca.

4. Chlorophyta

Green algae comprised 1.48 to 16.13 percent of the total phytoplankton. Average numbers decreased drastically from the river toward the lake. Highest total count (2035 units/ml) was recorded from the surface at station PP, lowest quantities (54 to 73 units/ml) were found in the lake and in bottom waters at stations MP and EP. At stations PP, MP and EP, maximum total populations were observed at the surface; the numbers were sharply decreasing with depth. In the lake, the vertical concentrations were uniform.

A total of 51 taxa of greens were included in the counts. Few species were found in abundance mainly in the river; many were common; the majority however were present in relatively small numbers (Table 3).

Actinastrum hantzschii was found in the river in an average quantity of 263 cells/ml. It occurred in much lower abundance (7 to 36 cells ml) in surface waters at MP and EP, and was absent from the lake station. A very similar pattern of occurrence was observed for Ankistrodesmus braunii (average count from the river; 107 cells/ml). Ankistrodesmus falcatus was present at all sampling depths; maximum count was 237 cells/ml at the bottom at PP, populations of similar sizes (45 to 55 cells/ml) were noted in surface waters at MP and EP, smallest quantities (8 to 28 cells/ml) were found in the lake, and in deeper waters in the middle plume and edge of the plume. Another member of the genus Ankistrodesmus, A. convolutus, was found in much smaller numbers (1 to 30 cells/ml) than the previous entities.

Present at most sampling depths, abundant in the river (mainly at the surface) and very common in surface waters at MP and EP were: Gloeocystis sp.(max. 267 cells/ml), Oocystis solitaria (max. 156 col/ml) and Dictyospherium pulchellum (max. 89 col/ml).

A few members of the genus Scenedesmus, S. abundans, S. dimorphus, S. incrassatulus and S. opoliensis, were found in all or most samples. As the former species they occurred in highest quantities in the river. Maximum counts of these entities from the surface at station PP, ranged from 45 col/ml (S. opoliensis) to 207 col/ml (S. incrassatulus). Other representatives of this genus, such as S. bijuga, S. perforatus, S. quadricauda, S. armatus, were found in smaller numbers (1 to 22 col/ml).

Several other green algae, members of various genera (Tetraëdron lunula, Closteriopsis longissima, Coelastrum sphaericum, Crucigenia apiculata, Pediastrum duplex, Desmatractum sp. and Closterium sp.) were very common in the river (average numbers ranged from 18 to 69 units/ml). They were either absent from other stations, or present in smaller quantities (1 to 10 units/ml).

Rather frequently noted, but present in low abundance, were species of Kirchneriella, Oocystis, Lagerheimia, Quadrigula and Tetraëdron.

5. Cyanophyta

Blue-greens comprised a small portion of the total phytoplankton (0.30 to 4.48 percent). Oscillatoria spp. were common in all samples: highest count (107 fil/ml) was found at the surface in the lake. The lowest (14 fil/ml) at the bottom in the river. Populations of identical sizes ca. 50 fil/ml, were observed in surface waters at PP, MP and at the surface and bottom at EP. Isolated peaks of Gomphosphaeria aponina (27 col/ml) and of Phormidium spp. (13 fil/ml) were observed at the bottom in the lake, and at the bottom in the river, respectively. Few other blue-greens such as Microcystis aeruginosa, Anabaena sp, or Aphanizomenon flos-aquae were only found sporadically in small numbers (0.4 to 5 units/ml).

6. Chrysophyta

Mallomonas spp. were found in the river in average numbers of 106 cells/ml. Quantities at MP and EP were similar (ave. 37 to 42 cells/ml) and higher than at the lake station (ave. 15 cells/ml).

Dinobryon divergens was common at the bottom in the river (but absent from the surface) and in top waters at MP and Lake (18 to 21 cells/ml). Smaller counts (7 to 12 cells/ml) were found at the remaining sampling depths.

D. calciformis was noted in few samples from MP, EP and Lake; 2 to 6 cells/ml.

Common at the bottom in the river was Ophiocytium capitatum v. longispinum (33 cells/ml). It was also present at three other sampling depths at MP and EP (1 to 5 cells/ml).

7. Pyrrophyta

Peridinium spp. were present at all sampling depths, except at the surface in the river. The numbers were relatively small (1 to 11 cells/ml).

8. Flagellates

Maximum total numbers, 1191 cells/ml, were found at the surface in the river. Minimum quantities, 29 cells/ml, were observed at 5 meters

depth at station MP; this count was strikingly small in comparison with those found at other sampling depths (105 to 814 cells/ml).

Average populations of Chlamydomonas sp. decreased from station PP (240 cells/ml) toward the lake (151 cells/ml). Surface counts from all stations (200 to 341 cells/ml) were much higher than those from deeper waters.

Average counts of Cryptomonas sp. found in the lake (67 cells/ml) were over ten times smaller than those from the river (703 cells/ml). As Chlamydomonas, these phytoplankters were also present in highest quantities in surface waters.

Euglena spp., Pteromonas sp., and Phacus sp. were common in the river (21 to 35 cells ml). Smaller numbers (1 to 10 cells/ml) were found at few other sampling depths.

H. July 25, 1969

1. Physical-Chemical Data

During the last ten days preceding sampling, the winds were from the north and the river plume was flowing south. It could still be seen for over 12 km south from the Grand Haven Piers, by its yellowish color, different from the clear green color of lake water. Figure 1h shows the location of July 1969 stations.

The physical data are presented in Tables 5h(1) and 6*l*. Surface water temperature decreased from 27.0°C in the river to 22.4°C at the lake station. It was 20.6°C at station MP 1. Vertical temperature gradients were noted in water columns at each sampling site, particularly well developed thermoclines were observed at both MP stations, EP and in the lake.

Secchi disc transparencies varied from 0.6 m in the river to 5.8 m in the lake. Highest amount of surface light at Secchi depth, 17.78 percent was noted at 2.7 meters in the edge of the plume.

According to calculations highest amount of river water in the plume area was present at the surface at station MP 4--19 percent.

Table 5h(2) shows the average chemical results. Highest values, except for dissolved oxygen content (maximum 11.0 ppm at both MP stations) and carbon dioxide (max. 2.5 ppm at MP 1) were found in the river. Lowest average values of oxygen, pH, alkalinity and chloride were found in the lake, and of the remaining parameters, either at MP 4 (carbon dioxide, nitrate), MP 1 (silica, sulfate, turbidity), or at EP (orthophosphate). Higher, than in the middle plume or edge of the plume, average results for some chemicals from the lake, were caused by relatively high individual bottom values (e.g., silica, nitrate) or surface values (e.g., orthophosphate) found at the lake station. The differences in concentrations of chemicals at various segments of water columns, are presented in Tables 6a to 6k. Particularly interesting were the results for orthophosphate, silica and nitrate. Complete depletion of phosphate was noted at most sampling depths in the

middle plume, edge of the plume and in the lake. Trace concentrations were observed in surface waters at MP 4 (1.9 ppb) and Lake (2.3 ppb), and also at 10 meters at MP 1 (0.5 ppb). At the same stations, the concentrations of silica and nitrate were very low, especially at the surface and within the metalimnion. With the exception of two higher silica values found at the bottom at EP (0.82 ppm) and Lake (2.15 ppm), most of the remaining values were lower than 0.51 ppm (the range was 0.21 to 0.51 ppm). The values of nitrate nitrogen in the upper segments of water columns ranged from 60 to 90 ppb, and in deeper water, from 110 to 240 ppb. The results for orthophosphate and silica at MP 4, MP 1, EP and Lake are striking when compared with the high values found in the river (ave. orthophosphate 64.3 ppb, ave. silica 2.01 ppm).

2. Phytoplankton Data

Maximum quantities of total phytoplankton (highest count; 18939 units/ml at the bottom at PP, which was also the highest count recorded duirng the study) and diatoms (16941 cells/ml at the bottom at PP) were found in the river and corresponded with maximum concentrations of nutrients and silica (Tables 1, 6e-h, and Figures 9a-d). High total phytoplankton (4114-5887 units/ml) and diatom populations (3082-4732 cells/ml) were found in the surface waters at both MP stations, at EP, and also at the bottom of station MP 4. These corresponded with a complete depletion of orthophosphate, low concentrations of silica (0.40-0.51 ppm) and nitrate (80-110 ppb). These results would suggest an increased demand in the plume area for silica and nutrients and particularly for phosphate, by the disproportionally abundant phytoplankters. Numbers of phytoplankton in surface waters at MP 4, MP 1 and EP were only about twice smaller than those at the surface in the river while phosphate values fell from 61.5 ppb (surface, PP) to zero; the amount of silica decreased by a factor of about four; and of nitrate by a factor of three. It may be that depletion of phosphate and perhaps insufficient light inhibited the growth of diatoms (ca. 1550 cells/ml) in bottom waters at stations MP 1, EP and Lake, where "unused" concentrations of silica were found

(0.82 ppm at EP and 2.15 ppm at Lake) and relatively high values of nitrates (130-240 ppb). Conversely, the smallest numbers of phytoplankton, 823 units/ml, (diatoms: 454 cells/ml) found in surface waters at the lake station, corresponded with "unused" (2.3 ppb) amounts of phosphate and scarce silica (0.36 ppm). The growth of diatoms in these waters was most probably inhibited by an inadequate supply of silica.

3. Bacillariophyta

Diatoms comprised between 55.17 percent and 94.76 percent of the total phytoplankton at the July sampling stations. In the river, at station MP 4 and in surface waters at stations MP 1, EP and Lake, Centrales were much more abundant (371 to 14419 cells/ml) than Pennales (83 to 2522 cells/ml). At the bottom of MP 1, EP and Lake, and within the thermoclines at the two last stations the Pennales made up a higher portion (49.30 percent to 87.15 percent and 711 to 1428 cells/ml) of total phytoplankton than the Centrales (7.61 to 34.59 percent and 123 to 1002 cells/ml).

Among the centric diatoms, Cyclotella meneghiniana v. plana, Melosira granulata v. angustissima and M. granulata occurred in large abundance in the river and in smaller, although high, quantities in the river plume area (MP 4, MP 1, EP). The first entity alone comprised about 50 percent of the total phytoplankton at station PP. Maximum cell counts of these species were found at the bottom in the river; 8935 cells/ml for C. meneghiniana v. plana (it was the highest count for this phytoplankter recorded during the study), 2700 cells/ml, for the second entity and 1246 cells/ml for M. granulata. Highest populations of all three species at stations MP 4, MP 1, EP and Lake were usually found in upper parts of the water columns. Average numbers of C. meneghiniana v. plana decreased from 6976 cells/ml in the river to 623 cells/ml at station EP, those of M. granulata v. angustissima from 1906 cells/ml (at PP) to 484 cells/ml (EP) and of M. granulata from 945 cells/ml (PP) to 93 cells/ml (EP). All three species were present in relatively small numbers in the lake (ave. 22 to 33 cells/ml).

Much less abundant in the river were C. meneghiniana (ave. 172 cells/ml) and Stephanodiscus subtilis (ave. 284 cells/ml). The former species was more common (26 to 113 cells/ml), than the latter (10 to 56 cells/ml), at most sampling depths at MP 4, MP 1, and EP. Both entities were present in small numbers (0.2 to 6 cells/ml) in bottom waters at MP 1, EP and in the lake.

Quite unexpectedly, present in high numbers in the river were Stephanodiscus alpinus (ave. 371 cells/ml) and Melosira islandica (ave. 203 cells/ml). During this study both phytoplankters were found in maximum abundance in March and April, at the edge of the plume and in the lake. Melosira islandica was absent from the river during all other months (except in May, when small quantities, 3 cells/ml, were observed at the surface), and S. alpinus was found in only several collections from the river in numbers usually smaller than 50 cells/ml. Most probably, both species were brought here from the lake with inflowing waters, at some time preceding the sampling. Both species were common (ave. 23 to 70 cells/ml) in the river plume area and lake (although M. islandica was absent from station MP 4), with highest numbers in surface waters at MP 1, EP and at the bottom in the lake.

Common in the river with average counts ranging from 28 to 47 cells/ml were: Melosira varians, Stephanodiscus astrea, S. hantzschii, S. minutus and S. tenuis. All these species were present in only a few samples from the other stations in small numbers (0.2 to 8 cells/ml). Higher quantities of S. tenuis were noted at the surface in the edge of plume: 28 cells/ml.

Common at most sampling depths of all stations, especially at the surface in the plume area (12 to 65 cells/ml) were: Cyclotella comta, C. kützingiana and C. stelligera. Lower abundance of these species was observed in deeper waters at EP and Lake (0.2 to 6 cells/ml).

Several species of the centric diatoms were absent from the river, but they were present often in high numbers at the other stations. Most abundant among them was Cyclotella operculata. Highest

populations of this entity were found in surface waters, with a maximum of 348 cells/ml at the edge of the plume. With the exception of two rather low counts (ca. 15 cells/ml) found in bottom waters at EP and Lake, numbers at other sampling depths ranged from 98 to 154 cells/ml. This species was not noted in collections from the previous months. Average quantities of C. ocellata were similar at MP 4, EP and Lake (24 to 31 cells/ml) and lower than at MP 1 (55 cells/ml). Sporadically common, or very common at a few sampling depths in the river plume area and lake were: Melosira granulata v. spiralis (max. 88 and 74 cells/ml in surface waters at EP and MP 1), Stephanodiscus binderanus (max. 69 cells/ml at the bottom, MP 4), Cyclotella pseudostelligera (max 32 cells/ml at the surface, EP), Melosira italica subsp. subarctica (max. 27 cells/ml, surface, MP 1), Stephanodiscus transilvanicus (max 15 cells/ml, bottom, Lake) and Coscinodiscus subsalsa (max 10 and 14 cells/ml at the surface at MP 4 and 8 meters depth at EP).

The Pennales were found in highest average quantities in the river (1683 cells/ml) and edge of the plume (1180 cells/ml). Average concentrations (722 to 783 cells/ml) were observed in the middle plume (MP 4, MP 1) and lake. At each sampling site, total numbers increased with depth. Cell counts of the most abundant genera are presented in Table 1, the relative abundance of species in Table 2, and numbers of identified taxa, found at various sampling depths, in Table 4h.

The genera Fragilaria, Navicula, Nitzschia and Synedra were found in maximum quantities in the river. Species belonging to the genera Tabellaria, Asterionella and Diatoma were either absent from the river (Asterionella) or present there in lowest abundance.

Highest count of Fragilaria crotonensis, 704 cells/ml, was recorded from the bottom at station PP, and smallest, 42 cells/ml, from the surface in the lake. Average populations at stations MP 4, MP 1, EP and Lake were quite similar (211 to 285 cells/ml) with the highest numbers found in deeper waters, especially at 8 meters, in the edge of the plume.

Maximum abundance of F. capucina was observed at the bottom of station MP 4 (426 cells/ml). Populations found in the edge of the plume and in the bottom waters in the lake ranged from 118 to 161 cells/ml. Numbers reported from the remaining sampling depths, except the bottom at station PP, where F. capucina did not occur, were much smaller, and ranged from 8 to 30 cells/ml.

Other species of this genus, F. brevistriata, F. construens and F. pinnata v. lancettula, were found abundantly in the river, especially at the bottom. Present in rather small quantities at the surface, but very common at the bottom were also F. construens v. binodis, F. intermedia and Fragilaria sp. #6. All of these entities were noted usually in only small numbers in the plume area and lake. A few other members of Fragilaria such as F. brevistriata v. inflata, varieties of F. construens-- F. construens v. pumila, F. construens v. minuta, and also F. vaucheriae v. truncata, were rare in the river or middle plume.

Highest counts of the genus Navicula were found in bottom waters at station PP (280 cells/ml) and MP 4 (98 cells/ml). Quantities found at all other sampling depths ranged from 1 cell/ml (surface Lake, and bottom MP 1) to 37 cells/ml (surface, PP).

Navicula decussis and N. tripunctata were abundant at the bottom in the river, common at the bottom of station MP 4 and present in much smaller quantities in surface waters at the same stations, and also at MP 1. While the former species was practically absent from the edge of the plume and the lake, the latter was rather common at the surface at EP, and rare in deeper waters at the lake station.

Common in the river with maximum concentrations at the bottom, and only rare at few other sampling depths in the plume area were: N. tripunctata v. schizonemoides, N. gastrum and N. viridula.

Relatively common in the bottom collection from the river, but rare in few other samples were: N. cryptocephala v. intermedia, N. scutelloides and N. oppugnata. The last species was also rather common at the bottom of station MP 4.

About 53 other representatives of this genus found in July, were noted only sporadically in very small numbers. More frequently noted were a few varieties of N. capitata, varieties of N. cryptocephala, and also N. latens, N. lanceolata and N. gregaria.

Average numbers of the genus Nitzschia decreased sharply from the river (233 cells/ml) toward the lake (8 cells/ml). Populations found in the edge of the plume (ave. 87 cells/ml) were higher than those in the lake, and at both middle plume stations (ave. at MP 4, 69 cells/ml, at MP 1 38 cells/ml).

Nitzschia sp. #2 was common at all sampling depths in the river and middle plume, and also at the surface of station EP, and bottom in the lake. Highest concentrations of this entity were observed in the river, especially in the bottom waters.

Common in the river, and present in smaller quantities at a few sampling depths of the other stations were: N. apiculata, N. woltereckii and N. hungarica.

Relatively common at the surface in the river and rare in a few samples from the plume area were N. amphibia and N. linearis.

N. thermalis was common at the bottom of stations PP and MP 4 and also at the surface of station EP. Common in deeper water at EP, and rare in the river and middle plume was N. dissipata.

All the remaining members of Nitzschia were noted sporadically, usually in small numbers.

Highest cell count of the genus Synedra found at the bottom in the river was 289 cells/ml; this was over twice the number observed at the surface. Total populations found at station MP 4 and in surface waters at MP 1 and EP ranged from 43 to 63 cells/ml. Numbers found in deeper waters at the two last stations and in the lake were much smaller (2 to 24 cells/ml).

Abundant in the river and common at station MP 4 were Synedra ulna v. spathulifera and S. acus. The latter species was also common at the surface of stations MP 1 and EP. Both entities were rare at a

few other sampling depths in the plume and in the lake. Synedra ulna was common in the river and present in much smaller abundance at the other stations. Relatively common at the bottom at MP 4 and surface at MP 1 were S. delicatissima v. angustissima and S. ulna v. chaseana. The former species was also quite common at the surface at station EP, and the latter at the bottom in the lake. Occasionally common either at MP 4, MP 1, EP or Lake were S. delicatissima and Synedra sp. (vaucheriae v. fragilarioides). Very rare, but present in most samples from the plume area and lake, was S. ulna v. danica. Few other species of this genus as S. demerarae, S. fasciculata, S. parasitica and its variety S. parasitica v. subconstricta were noted only sporadically.

Tabellaria fenestrata, representative of the genus Tabellaria, occurred in large abundance in the plume area and lake, with concentrations sharply increasing with depth. Maximum counts were recorded from the bottom at station EP (940 cells/ml) and Lake (830 cells/ml). Other counts from deeper water ranged from 183 to 658 cells/ml and those from the surface at all stations from 10 cells/ml (Lake) to 96 cells/ml (MP 1). This phytoplankter was absent from the bottom in the river though quantities of ca. 37 cells/ml were observed at the river surface. T. flocculosa was rather common, ca. 24 cells/ml, at the bottom of station MP 1, and present in smaller numbers in deeper waters at EP and Lake.

The genus Asterionella was mainly represented by A. formosa, which was common at most sampling depths in the river plume and Lake. Common at the bottom at station MP 1, and within the thermoclines at EP and Lake was also A. gracillima. Total counts of Asterionella ranged from 6 cells/ml, at the surface in the lake, to 77 cells/ml at 8 meters depth of station EP. Generally, higher concentrations were found in deeper waters. Members of this genus were absent from the river and the surface of station MP 1.

Average cell counts of the genus Diatoma found at stations MP 4, MP 1 and EP were of similar sizes (22 to 26 cells/ml and higher than those in the river (13 cells/ml) and lake (4 cells/ml). Diatoma

tenue v. *elongatum* was present in all collections except those from the river. The nominate variety of this species, *D. tenue* was found only at the plume stations, in quantities usually smaller than the former entity. Common at the bottom in the river, ca. 20 cells/ml, and rare or very rare at most other sampling depths was *D. vulgaris*.

Many other species of the pennate diatoms (about 84), members of various genera such as *Achnanthes*, *Amphora*, *Cocconeis*, *Gomphonema*, *Cymbella* etc., were found in the July collections, especially those from the river and river plume. Few of them were common at station PP, and sporadically in surface waters, rarely at the bottom, at MP 4, MP 1 or EP. They were absent from or present in very low abundance at some of the remaining sampling depths. To this group belonged: *Achnanthes lanceolata* v. *dubia*, *Gomphonema olivaceum*, *Rhoicosphenia curvata*, *Amphora ovalis* v. *pediculus*, *A. ovalis* v. *libyca*, *Cocconeis placentula* and *C. pediculus*.

Several species were observed commonly only in the river; they were rare at the other stations. To these belonged: *Achnanthes hauckiana* v. *rostrata*, *A. lanceolata*, *Opephora martyi*, *Gomphonema angustatum*, *Amphora ovalis*, *Cymbella sinuata*, *Cocconeis dimunuta*, *C. placentula* v. *euglypta*, *C. thumensis* and *Cymatopleura solea*.

Two members of the genus *Achnanthes*, *A. lauenburgiana* and *A. microcephala* were rather common at the surface in the edge of the plume. The former species was noted also in small quantities in the river and at MP 4, the latter was absent from all other stations. Another species, *Amphora neglecta* was quite common in the bottom at EP, and rare at the bottom in the lake.

All the remaining diatoms were found occasionally and in small numbers.

4. Chlorophyta

In the July collections, green algae comprised between 1.8 percent and 17.9 percent of the total phytoplankton. At all stations, except PP, maximum concentrations of the greens were observed

in surface waters; the quantities were rather sharply decreasing with depth. Highest cell count, 1524 units/ml, was recorded from the bottom in the river, lowest, 32 and 38 units/ml, from the bottom in the lake and edge of the plume. Average numbers in the lake (84 units/ml) were over 15 times smaller than those in the river (1285 units/ml). Total populations found in the plume area, at MP 4 (ave. 393 units/ml), MP 1 (ave. 329 units/ml) and EP (ave. 260 units/ml) were of similar sizes. The flora was very diverse: 82 taxa were included in the counts (Table 3).

Among 11 representatives of Scenedesmus, five species were present at all stations, and mostly contributed to the total quantities of this genus. Scenedesmus abundans and S. opoliensis occurred in high numbers in the river, especially at the bottom (maxima: 260 and 74 colonies/ml, respectively), were common at station MP 4, and in the upper parts of the water columns at MP 1 and EP (13-44 colonies/ml). S. quadricauda (max. at PP, 31 col/ml) and S. dimorphus (max.at PP: 22 col/ml), were less abundant at the same sampling depths. S. incrassatulus was very common in the river (ave. 37 col/ml) and present only at few other sampling depths in small numbers (1-8 col/ml). Another species, S. acuminatus, was quite common in the river (ca. 11 col/ml) but absent from all other stations. All remaining members of this genus were noted occasionally, in smaller quantities (1-7 col/ml). Lowest abundance of Scenedesmus (1-5 col/ml) was observed in the lake.

The genus Oocystis was mainly represented by O. solitaria. Average populations of this entity in the plume area and lake were of similar sizes (20-23 col/ml) and over three times smaller than those in the river (70 col/ml). Present at most sampling depths, in relatively small quantities (1-12 col/ml), were O. borgei, O. lacustris, O. pusilla and O. parva. Few other species were included in the total counts of Oocystis spp. (8-58 col/ml); higher concentrations were generally observed in surface waters.

Among other members of the green algae, most abundant in the river, at MP 4, and in surface waters at MP 1 and EP were: Gloeocystis

sp. (48-148 col/ml), Dictyospherium pulchellum (13-104 col/ml), and Ankistrodesmus falcatus (12-69 cells/ml). Gloeocystis sp. was also common (9-22 col/ml) in the lake, at the bottom of station MP 1 and at 8 meters depth at EP, while the two latter phytoplankters were present there in small numbers (1-6 units/ml).

Very common in the river were Closteriopsis longissima (ave. 63 cells/ml) and Coelastrum sphaericum (ave. 55 col/ml). The former species was common also at the surface of stations MP 4, MP 1 and EP (11-18 cells/ml) and was absent from the lake. The latter was noted at most other sampling depths in low abundance (1-10 col/ml).

Much less abundant at station PP, and relatively common in surface waters in the plume area (ca. 9-30 units/ml) were Crucigenia quadrata, Nephrocytium agardhianum, Tetrastum staurogeniaeforme and Pediastrum spp. These algae were either absent from the lake, or present in very small numbers (0.4-2 units/ml).

Common in the river (maximum counts ranged from 22-37 units/ml) and present only in small quantities (usually 1-7 units/ml) at the other stations, mainly in the plume area, were: Actinastrum hantzschii, Kirchneriella elongata, K. obesa, Tetraëdron lunula, T. minimum and Closterium spp.

Several species of the greens, members of about ten different genera, were noted in rather high quantities in the river. With only a few exceptions they were absent from all other sampling stations. To this group belonged: Desmatractum sp., Dimorphococcus lunatus, Lagerheimia quadriseta, Pediastrum duplex, Gloeocystis planctonica, Kirchneriella lunaris, Tetradesmus smithii, Tetraëdron caudatum, Treubaria setigerum and Westella linearis. Counts of all of these species in the river, except the last one, ranged from 15 to 45 units/ml. Westella linearis occurred in large abundance of 96 col/ml, at the surface.

Two isolated peaks of Crucigenia tetrapedia were observed in surface waters at station MP 4 (14 col/ml) and EP (21 col/ml). Another species of this genus C. apiculata was abundant at the surface at MP 4; 94 col/ml, and common at the bottom in the river (22 col/ml). It was also present at a few other sampling depths (0.4-7 col/ml).

Frequently noted, but present in small numbers, usually 1-7 units/ml were: Ankistrodesmus braunii, Elakatothrix gelatinosa, Staurastrum spp., Tetraëdron trigonum (these entities were practically absent from the lake), Cosmarium sp., Oedogonium sp. (these were absent from the river). Another green alga, Quadrigula lacustris, was observed at all sampling depths, except at the bottom in the lake, ranging from 2 to 17 col/ml. Quantities above 10 col/ml were found in surface waters at stations MP 1, EP and Lake. All remaining greens were noted sporadically, in low abundance.

5. Cyanophyta

Blue-greens occurred in relatively small quantities, and were not found in the surface samples from station PP. Higher numbers (25-37 units/ml) were observed in bottom waters in the river, lake and at MP 1, and also at the surface at MP 1 and EP. Other counts ranged from 3 to 15 units/ml.

Oscillatoria spp. were present in most collections. Quantities at both MP stations and at the bottom in the river, 5-8 filaments/ml, were higher than those at few sampling depths at EP and Lake, 1-3 fil/ml, however, the maximum count, 22 fil/ml, was found at the bottom in the lake.

Phormidium spp. were noted at MP 1 and EP (2-15 fil/ml), and also at the bottom at PP (22 fil/ml).

Anabaena spp. were present at the plume stations and lake (1-8 fil/ml) with higher numbers at the surface at MP 1 and EP. They were absent from the river and bottom waters at EP and Lake. Few other blue-greens were noted in only few samples, in small abundance,usually 1-4 units/ml.

6. Chrysophyta

Chrysophyta comprised between 0.22 percent (at the surface, PP) and 23.92 percent (surface, Lake) of total phytoplankton.

Dinobryon divergens was abundant in most samples from the river plume and lake (186 to 357 cels/ml). It was absent from the bottom at PP and Lake. Smallest quantities were found at the surface in the river (7 cells ml) and bottom at station EP (32 cells/ml). Dinobryon bavaricum and D. calciformis were noted in the plume area (1-16 cells/ml).

Mallomonas spp. were very common in the river (ave. 52 cells/ml). Much smaller populations (2-14 cells/ml) were found at the other stations.

Ophiocytium capitatum v. longispinum and Tribonema sp. were identified in few collections (1-8 units/ml).

7. Pyrrophyta

This group of algae was mainly represented by Peridinium spp. Average concentrations at the middle plume and edge of the plume were identical (23-25 cells/ml) and smaller than in the river (78 cells/ml). Minimum quantities (ave. 6 cells/ml) were found in the lake.

Except in the lake, highest numbers were observed in surface waters.

8. Flagellates

Chlamydomonas sp. were found in highest abundance in the middle plume; average quantities at both MP stations, ca. 112 cells ml, were twice the size of those observed in the river, (55 cells/ml) and edge of the plume, 48 cells/ml. Smallest numbers, ave. 11 cells/ml, were noted in the lake.

Populations of Cryptomonas decreased drastically from the river (ave. 200 cells/ml) toward the middle plume (ave. at MP 4, 52 cells/ml, ave. at MP 1; 60 cells/ml), and then gradually toward the Lake (ave. 10 cells/ml). At each station, except the Lake, maximum concentrations of both Chlamydomonas and Cryptomonas were found in surface waters; generally, the quantities were sharply decreasing with depth.

Common in the river were: Euglena spp. (ave. 33 cells/ml) and Pteromonas sp. (ave. 11 cells/ml).

I. August 29, 1969

1. Physical-Chemical Data

Figure 1i shows the positions of the August stations. The winds were from the southwest; under the influence of strong on-shore current the river plume was turning sharply toward the north. The same situation had lasted for about two days preceding the sampling time. It was difficult to see the plume at all, except for the turn to the north.

Table 5i(1) summarizes the physical data. The surface water temperature decreased from 24.9°C in the river to 23.2°C at the plume edge. The lake water was slightly warmer (23.8°C) than at station EP. Surface to bottom temperature variations were observed at each sampling site--at both lake stations the bathythermograph measurements indicated well developed summer stratification (Table 6*l*).

The Secchi disc transparencies increased from 0.7 m in the river to 4 m at station Lake 1 and to 5 m at Lake 2. The amount of surface light at Secchi depth varied from 5.76 percent at 3.5 m (EP) to 17.5 percent at Lake 2.

Calculations indicated that the waters in the middle plume contained 47 percent of river water at the surface, and 52 percent at the bottom.

Table 5i(2) shows the average chemical results. With the exception of oxygen content (maximum 9.3 ppm at EP and Lake 1), pH (similar values, ca. 8.8, at all stations) and nitrate (max. 100 ppb at Lake 2), the highest concentrations of the remaining seven parameters were found in the river. The individual chemical values found at various depths are presented in Tables 6a-6k. Oxygen, pH, alkalinity, chloride and sulfate concentrations showed in most cases little or no variations with depth, especially at stations MP, EP and in the lake. The values of carbon dioxide and turbidity were usually highest in deeper and bottom waters. Except for a single high silica value (2.60 ppm, at the bottom of station Lake 2), very low silica concentrations 0.31-0.58 ppm were found in the edge of the plume and in the

lake (Lake 1, Lake 2), especially at 1 and 5 meters depth. Complete depletion of orthophosphate was observed at most sampling depths at the same stations, trace amounts were found at Lake 1 (0.1 ppb at 5 m, and 0.2 ppb at the bottom) and Lake 2 (0.5 ppb at 18 m). Very low concentrations of nitrate, 0-90 ppb, were noted at all stations, except at the bottom of Lake 2, (180 ppb).

2. Phytoplankton Data

Figures 10a to 10f illustrate the surface, bottom and the average phytoplankton counts and also the corresponding values of nutrients and silica. Maximum quantities of total phytoplankton (14433 units/ml), diatoms (10093 cells/ml), and greens (4057 units/ml--the highest count recorded during the study) were found at the bottom in the middle plume. Very high abundance was observed also in the river, at the 6 m depth (total phytoplankton 11325 units/ml; diatoms 8334 cells/ml) and at the bottom (total phytoplankton 10524 units/ml; diatoms 7556 cells/ml). The second highest count of the green algae (2976 units/ml) was recorded from the surface at MP; the numbers exceeded those of diatoms--2844 cells/ml. The concentrations of phytoplankton in deeper waters at both PP and MP were much higher--at least twice as high at MP, and four times as high at PP than in the upper parts of the water columns.

The average quantities of diatoms found in the middle plume (5106 cells/ml) were smaller than in the river (5705 cells/ml) but the average abundance of total phytoplankton increased from 7996 units/ml at PP to 8700 units/ml at MP, due to the peak development of the green algae (ave. at PP, 1705 units/ml and average at MP; 2907 units/ml). The high abundance of total phytoplankton in the middle plume corresponded with average values of silica of 1.06 ppm and orthophosphate of 21.1 ppb which were much decreased in comparison with the river station (silica, 2.22 ppm and orthophosphate, 62.1 ppb); particularly, the maximum counts found in bottom waters corresponded with minute amounts of orthophosphate, 9 ppb, suggesting a biological uptake of this nutrient. (The average concentrations of nitrate at

MP were very small, however, somewhat higher than at PP due to the higher bottom values). It seems also, that the large amounts of phytoplankton in the middle plume could be attributed partly to the accumulation of incoming river phytoplankton, kept from dilution in the lake water by the strong on-shore current.

Rather unexpectedly, the phytoplankton quantities at station EP (ave. total phytoplankton 1072 units/ml, ave. diatoms 498 cells/ml and ave. greens; 435 units/ml) were strikingly small in comparison with the abundance in the river and in the middle plume. Most probably, despite the misleading yellowish color of the water, it was not the edge of the plume, but lake water, or water of the current along the shore. The values of alkalinity, sulfate and chloride were slightly lower or identical with those found in the lake, and the surface temperature was lower than at both lake stations. It seems, that the growth of phytoplankton at station EP was inhibited by a complete depletion of orthophosphate and scarce amounts of silica (ave. 0.49 ppm) and nitrate (ave. 36 ppb). However, it may well be that phosphate was the responsible limiting factor.

The minimum quantities of phytoplankton, only slightly smaller than at EP, were observed in the lake. Epilimnions (1 and 5 meters depth) at both stations and the metalimnion of Lake 1 (11 meters) were almost completely devoid of diatoms (1-32 cells/ml), however, diatoms were found in deeper waters, at the bottom at Lake 1 (1352 cells/ml), and at 18 meters (629 cells/ml) and bottom (388 cells/ml) at Lake 2, in numbers higher than other phytoplankton groups. The average quantities of the green algae at both stations (Lake 1 429 units/ml, and Lake 2 328 units/ml) were higher than those of diatoms (Lake 1 356 cells/ml and Lake 2 255 cells/ml)--the total populations were decreasing with depth, and the counts found at the surface were 639 units/ml at Lake 1 and 543 units/ml at Lake 2. Blue-green algae occurred in the lake in much smaller abundance than the greens (ave. at Lake 1 72 units/ml, and at Lake 2 53 units/ml), but higher than the Flagellates, Pyrrophyta and Chrysophyta. As the greens,

they were found in highest concentrations of ca. 94 units/ml in surface waters. The growth of phytoplankton in the lake, and expecially the growth of diatoms in the upper parts of the water columns, was evidently inhibited by the depletion of phosphate and very low concentrations of silica and nitrate (see discussion in Section V, subsection B. The Lake).

3. Bacillariophyta

In the river, middle plume, edge of the plume, in bottom waters at both lake stations, and also within the metalimnion at Lake 2, diatoms comprised between 40.83 percent (surface, MP) and 83.56 percent (bottom, Lake 2) of total phytoplankton. Within the epilimnions at the lake stations, and the metalimnion at Lake 1, they made up only 0.40 percent to 7.79 percent of the total. At PP, MP and at the bottom at EP, Centrales were much more abundant (37.70 percent to 64.01 percent) than Pennales (5.02 percent to 10.03 percent). At most sampling depths in the lake and in the upper parts of the water column at EP, the abundance of the pennate diatoms equaled or somewhat exceeded the quantities of the centrics. Diatoms, cell counts, and the relative abundance of diatoms in total phytoplankton are presented in Tables 1 and 2. Numbers of species found at various sampling depths are shown in Table 4i.

Three species of the Centrales, Cyclotella meneghiniana v. plana (max. 2919 cells/ml, bottom, MP), Melosira granulata (max. 2922 cells/ml, bottom, MP--it was also the highest count recorded for this phytoplankter) and M. granulata v. angustissima (max. 1172 cells/ml, bottom, PP), dominated total diatom populations in the river and middle plume. Average numbers of the first species declined from PP (1803 cells/ml) toward MP (1302 cells/ml) and EP (75 cells/ml). Very small quantities were observed at all sampling depths in the lake, expecially in the epilimnion; 0.2-9 cells/ml. Melosira granulata was present at MP (ave. 1727 cells/ml) in quantities higher than at PP (ave. 1363 cells/ml) and over ten times higher than at EP (ave. 163 cells/ml). Unlike the former entity, it was also abundant in

bottom waters in the lake and at 18 meters at station Lake 2 (84-353 cells/ml). Minimum numbers (0.2-1 cells/ml) were noted in the epilimnions at both lake stations. Concentrations of M. granulata v. angustissima were quite similar at both PP (ave. 674 cells/ml) and MP (ave. 569 cells/ml). Rather large quantities (202 cells/ml) were also observed at the bottom at Lake 1. Lower abundance was found at EP and in deep waters at Lake 2 (7-29 cells/ml). This entity was practically absent from 1 and 5 meters depth in the lake.

Less abundant in the river and middle plume were: C. meneghiniana, C. comensis and C. cryptica. The second species was not noted in any other collections during the previous months, and C. cryptica only occurred in small abundance (1-5 cells ml) in March and November, in the plume area. Highest count of C. meneghiniana, 555 cells/ml, was found at 6 meters depth at PP, also the average quantity at this station (313 cells/ml) was higher than at MP (207 cells/ml). Very small numbers (0.1-3 cells/ml) were observed in the top waters at the remaining stations; a somewhat higher cell count (16 cells/ml) was found at the bottom at EP. Cyclotella comensis was more abundant than C. cryptica at both stations PP and MP. Counts of the former species ranged from 61 to 615 cells/ml, and of the latter from 13 to 433 cells/ml. Maximum populations of both entities occurred at 6 meters depth in the river and at the bottom in the middle plume. Both species were absent from the lake. They were noted in small numbers (0.1-11 cells/ml) at station EP.

Two representatives of the genus Stephanodiscus, S. subtilis and S. tenuis, were very common in the river, with highest concentrations at 6 meters (115 cells/ml and 74 cells/ml respectively). The former species was noted also in one sample from MP (8 cells/ml) and EP (1 cell/ml). The latter was present at all depths at MP (ave. 9 cells/ml) and at the bottom at Lake 2 (0.1 cell/ml).

Coscinodiscus subsalsa was noted at all five stations. Two maximum cell counts were found in bottom waters at MP (41 cells/ml) and PP (35 cells/ml). Numbers observed at other sampling depths, in

the river, middle plume and at EP, ranged 1-9 cells/ml. Only isolated individuals were noted in three samples from the lake. Another member of this genus, Coscinodiscus sp., which was never found during the previous months, was present in the river and middle plume in larger abundance than C. subsalsa; its highest counts were found at the bottom at MP (82 cells/ml) and at 6 meters at PP (67 cells/ml). This entity was absent from the lake samples and only few cells were noted in two collections from station EP.

Common in the river, especially at the bottom (ave. 46 cells/ml), and absent from all other stations was Cyclotella striata which as the former entity (Coscinodiscus sp.), was not observed during the previous months.

Several other centric diatoms were relatively common (at most 41 cells/ml) at few sampling depths either at PP, MP or EP, mainly in deeper waters. With the two exceptions of C. comta and C. operculata they were absent from the lake or present there in very small abundance. Melosira varians was found in the river (ave. 25 cells/ml), and in three samples from the middle plume and edge of the plume (0.2-11 cells/ml). It was absent from the lake. Common in the river and middle plume were Stephanodiscus hantzschii (3-35 cells/ml) and S. minutus (3-32 cells/ml). Both entities were present at EP and in the lake (0.1-1 cells/ml)--the latter species was more frequently noted than the former one. Highest abundance of S. alpinus (9-41 cells/ml) was observed at the bottom at PP, MP and EP. Counts found in the upper parts of the water columns at MP, EP and in the lake ranged from 0.1 to 7 cells/ml. Cyclotella comta and C. operculata were noted in most collections. The former species was common (9-32 cells/ml) in the middle plume, edge of the plume and in deeper waters at both lake stations. Quantities found in top waters in the lake and river were much smaller; 0.2-5 cells/ml. The latter entity was present in highest numbers (12-41 cells/ml) at MP and at the bottom of stations PP, EP and Lake 1. Low abundance (0.1-2 cells/ml) was observed at the upper sampling depths at EP and in the lake.

Five other representatives of the Centrales, Cyclotella kützingiana, C. ocellata, C. pseudostelligera, C. stelligera and Stephanodiscus astrea, were noted in only a few samples in small numbers, usually 0.1-9 cells/ml. Their quantities found at EP and in the lake were always very small; 0.1-2 cells/ml.

Two more phytoplankters, Melosira islandica and Stephanodiscus transilvanicus, were found in the lake, the latter also at station EP. Both were absent from the river and middle plume. The first species was common (22 cells/ml) at the bottom at Lake 1, and very common (77 cells/ml) at the bottom at Lake 2. Isolated cells were noted in samples from 5 and 11 meters depth at station Lake 1. The second entity was observed only in very small abundance (0.1-1 cells/ml) at a few sampling depths at EP and in the lake.

In August the flora of the Pennales was very rich; they were represented by 279 taxa, with the Centrales by 27. As in all previous months, highest numbers of species belonged to the family Fragilariaceae (50) and genera Navicula (73), Nitzschia (32) and Achnanthes (21). About 51 taxa were included in counts of various rare diatom species. Generally, the largest diversity of species--including also the centric diatoms--was observed in the middle plume (251 taxa) and the smallest in the lake (43-48 taxa), Table 4i.

Maximum concentration of Fragilaria crotonensis, 500 cells/ml, was found at the bottom at station Lake 1; only small numbers (1-15 cells/ml) were noted in the upper waters. This species was absent from the epilimnion at Lake 2, but, as at the first station, it was present there at the bottom (33 cells/ml) and at the lower level of the thermocline, at 18 meters (179 cells/ml). The quantities found at other stations declined from the river (ave. 152 cells/ml) toward the middle plume (ave. 111 cells/ml) and EP (40 cells/ml). The highest count (289 cells/ml) was recorded from the bottom of PP. It should be pointed out here that the entities observed in the river, middle plume and edge of the plume, differed somewhat in shape and size from those found in the lake--it was decided to designate them rather as varieties of F. crotonensis.

The highest count of F. capucina (68 cells/ml) was found in the bottom water at Lake 1. Populations at the bottom at MP and at the levels of the thermoclines at EP and Lake 2, were of identical sizes; 45-51 cells/ml. The average numbers in the river, middle plume and edge of the plume ranged from 10 to 28 cells/ml. As with F. crotonensis, this species was also absent from the epilimnion at Lake 2 and was present in low quantity, ca. 3 cells/ml in the epilimnion at Lake 1. Counts of F. capucina included also those of F. capucina v. mesolepta; this entity was common in deeper waters at all stations. Another variety of this species, F. capucina v. lanceolata was noted in very low abundance at the bottom at PP and EP, and at 5 meters at MP.

About 17 other members of the genus Fragilaria were found in collections from the river, middle plume and edge of the plume. Most of them were absent from the lake. Only F. intermedia was relatively common at the bottom at station Lake 1, also F. construens and F. vaucheriae v. capitellata were noted in very small numbers at the same station. The two first species were common at practially all sampling depths at PP, MP and EP. A few varieties of F. construens were present in lower quantities; most abundant was F. construens v. binodis, especially in deeper waters, and at the surface at EP. Fragilaria vaucheriae v. capitellata occurred rather numerously at the level of the thermocline and at the bottom in the middle plume and edge of the plume. It was absent from the river. A related entity, F. vaucheriae v. truncata, was common in deeper water at PP and rare at MP and EP. Relatively common in most samples from the river and plume area was F. brevistriata v. inflata. The nominate variety, F. brevistriata, was present in higher numbers in the river but was rare at stations MP and EP. Largest populations of both species were observed at 5 meters depth and at the bottom of PP. Fragilaria pinnata and F. pinnata v. lancettula were found at all three stations (PP, MP, EP) with highest quantities in the river, and at the bottom in the middle plume. Few other entities as F. leptostauron v. dubia, Fragilaria sp. #6 and Fragilaria sp. #11, though were present in most samples from the river and plume area, occurred in lower abundance.

Maximum total quantities of the genus Synedra were found at the bottom in the middle plume 230 cells/ml. Smaller abundance was observed at the surface of the same station (84 cells/ml) and in deeper water in the river (ca. 115 cells/ml). An average of about 7 cells/ml was noted at EP, and still smaller numbers (2 cells/ml) were found at the bottom at both lake stations. Only isolated specimens of a few species were noted in the upper parts of the water columns in the lake.

Among 18 members of this genus included in counts, most abundant at stations PP, MP and EP were: S. ulna v. spathulifera, S. ulna v. oxyrhynchus, S. acus and S. ulna; the same species, except the second one, were noted in the lake. Rather large populations of S. delicatissima v. angustissima were observed at 6 meters depth in the river, and at the bottom in the middle plume. Common in the bottom water at MP were also: S. delicatissima, S. parasitica v. subconstricta and S. ulna v. claviceps. The former two entities were only present in small quantities in few other samples. The latter was commonly found at the bottom in the river. A few other species such as S. fasciculata, S. parasitica, S. pulchella, S. ulna v. contracta and S. ulna v. chaseana, were noted in small abundance in the river and middle plume. The last entity was present also at stations EP and Lake 2.

Representative of the genus Tabellaria, T. fenestrata was present at all stations. Highest count, 113 cells/ml, was found at the bottom at Lake 2. A smaller quantity, 42 cells/ml, was observed at 18 meters at the same station; populations of similar sizes (40-55 cells/ml) were found in bottom waters at station Lake 1 and in the middle plume. Numbers found in the upper waters in the lake and at MP, and in the edge of the plume ranged from 1-11 cells/ml, with higher quantities noted at the two last stations. Very low abundance, ca. 0.3 cells/ml, was found in the river.

Asterionella formosa, the only representative of this genus identified in the August collections, was found in largest quantity (59 cells/ml) at the bottom in the river. Numbers noted at other sampling depths, at stations PP, MP and EP were small; 0.1-9 cells/ml. This

phytoplankter was present also in the lake at the bottom of station Lake 1 (11 cells/ml) and at 18 meters at Lake 2 (31 cells/ml).

Maximum quantity of the genus Diatoma was found at the bottom at station MP (27 cells/ml). An average of about 7 cells/ml was noted in the river, an equally small population (8 cells/ml) was observed in bottom waters at Lake 1. Still lower abundance, 0.1-2 cells/ml was noted in a few samples from EP, top waters at MP and from the thermocline at Lake 2. Most common in the river and the plume area was D. vulgaris. Two varieties of this species, D. vulgaris v. brevis and D. vulgaris v. linearis were present in the river and at the bottom at MP. Diatoma tenue v. elongatum was the only member of the genus found in the lake; it was rare at MP and EP and absent from the river.

Highest total cell counts of the genus Nitzschia were found in the river (309 cells/ml at 6 meters, and 219 cells/ml at the bottom) and in the middle plume (295 cells/ml at the bottom). Average quantities decreased from the river (190 cells/ml) toward the middle plume (140 cells/ml), and declined drastically toward the EP (19 cells/ml). In the lake, members of this genus were only found in deep waters, with concentration of 47 cells/ml at the bottom at Lake 1 and 32 cells/ml at 18 meters at station Lake 2.

Species which contributed mostly to the total abundance of Nitzschia at the three stations PP, MP and EP were: N. woltereckii, entities designated as Nitzschia sp. "A" and Nitzschia sp #2, N. palea and N. dissipata. Nitzschia sp. #2 was also common at 18 meters at Lake 2 and somewhat less numerous at the bottom of Lake 1. Present in high concentrations in the river and middle plume, mainly in deeper water but virtually absent from station EP were: N. bacata, N. capitellata, N. linearis and N. hungarica. Somewhat less abundant at the same sampling depths were N. amphibia and N. fonticola. Sporadically common in collections from PP or MP were: N. acuta, N. spiculoides, N. tryblionella (they were found at 6 meters at PP) and N. tryblionella v. levidensis (noted at the bottom of MP). Rather numerous at station EP and the bottom at MP was N. recta. Nitzschia acicularis was common in deep samples from Lake 1; it was present

usually in much smaller quantities at PP, MP and EP. This species and formerly mentioned Nitzschia sp. #2 were practically the only representatives of the genus found in the lake--only in deep waters.

Average abundances of the genus Navicula were of similar sizes in the river (76 cells/ml) and in the middle plume (68 cells/ml); highest concentrations were found in deeper waters. Numbers noted at station EP were much smaller (ave. 9 cells/ml). In the lake, the only appreciable quantity of this genus was observed at station Lake 1 (3 cells/ml at the bottom).

Among 73 representatives of Navicula taken in the August collections, most abundant in the river, middle plume and edge of the plume were: N. tripunctata and N. decussis--they were also present in the lake. Common or relatively common in the river and middle plume, particularly at station PP, and rare at EP were: N. tripunctata v. schizonemoides, N. viridula, N. gastrum, N. lanceolata, Navicula sp. (pygmaea v. producta), N. cryptocelphala v. intermedia, N. pupula and N. capitata. A few species N. cryptocephala, N. gregaria, N. heufleri, N. oppugnata and N. scutelloides which were usually present in low quantities at most sampling depths at PP, MP and EP, were found in higher numbers only at 6 meters depth in the river and at the bottom in the middle plume. Isolated higher counts of several other entities, N. cuspidata, N. imbricata, N. cryptocephala v. veneta, N. radiosa, N. radiosa v. tenella and N. viridula v. rostellata were observed at the same stations, at various depths. Two species, N. latens and N. menisculus v. upsaliensis were very common at the bottom in the middle plume and quite common at EP--they were rare in the river and the upper segments of water columns at MP. Present in all or most samples from PP, MP and EP, always in low abundance were: N. capitata v. hungarica, N. confervacea, N. protracta v. elliptica, N. paludosa (absent from EP) and N. costulata (noted also at Lake 1). Few varieties of N. anglica and N. clementis and also N. platystoma v. pantocsekii and N. pupula v. rostrata were noted frequently but in low quantities, mainly in the middle plume and edge of the plume.

A large number of diatom species, about 123, members of genera Achnanthes, Amphora, Cocconeis, Cymbella, Gomphonema and many others were found in this month's collections, especially in those from stations PP, MP and EP. Only 19 of them were found in the lake, always in very low quantities.

Very common or common in most samples from the river, middle plume and edge of the plume, with highest concentrations in deeper waters, usually decreasing toward the EP were: Rhoicosphenia curvata, Gomphonema olivaceum, Achnanthes lanceolata v. dubia, Cocconeis placentula, C. placentula v. euglypta, C. pediculus, Amphora ovalis v. pediculus and A. ovalis v. libyca.

Somewhat less abundant at the same sampling depths in the river and middle plume and usually rare at station EP were: Achnanthes lanceolata, A. hauckiana v. rostrata, A. clevei, A. hungarica (it was absent from EP), Amphora ovalis, A. ovalis v. gracilis (common also at the bottom at EP), Cocconeis diminuta, C. thumensis, C. placentula v. lineata (common at bottom, EP), Gomphonema angustatum and Opephora martyi (common at 5 meters, EP).

Present in still smaller quantities at the same stations (PP, MP) were: Cymbella sinuata, C. ventricosa, Cymatopleura solea and Meridion circulare.

Several species were found commonly only in solitary samples either from the river, middle plume or edge of the plume. They were rare or absent from all the remaining collections. Thus relatively common at 6 meters depth in the river were: Achnanthes conspicua, Bacillaria paxillifer, Caloneis amphisbaena (also at the bottom), Surirella ovata, Rhopalodia gibba and varieties of Gomphonema olivaceum. Common at the bottom in the middle plume were: Cymbella tumida, Gomphonema angustatum v. producta and G. gracile. Common at the bottom in the edge of the plume were: Achnanthes affinis, Amphora calumetica and Neidium sp. #3. Three more species were found in rather high numbers at the same station (EP): Caloneis ventricosa was common at all sampling depths, mainly at the surface; Amphora neglecta was very

common at 5.5 meters depth and present in much smaller quantity at the bottom; and A. siberica occurred numerously at 1 and 5.5 meters and also at 5 meters at station MP.

Species present in the lake were in most cases the same as those which occurred commonly in the river, middle plume and edge of the plume.

4. Chlorophyta

At stations MP, PP and EP green algae comprised between 18.54 percent and 46.19 percent of the total phytoplankton. In the epilimnions at both stations in the lake, and at the level of the thermocline (11 m) at station Lake 1 they made up between 71.54 percent and 84.17 percent of the total, much more than in the deeper waters (11.06 to 32.73 percent). In the river and middle plume, total counts of the greens varied from 660 units/ml (surface, at PP) to 4057 units/ml (bottom, at MP). At station EP and in the lake, all counts except the smallest (51 units/ml, bottom, at Lake 2) ranged from 301 units/ml (11 meters, Lake 1) to 639 units/ml (surface, Lake 1). Generally, at stations PP, MP and EP highest concentrations were found in deeper water and in the lake at the surface. The flora of the greens was very diverse, 109 taxa were included in the counts (Tables 3 and 4i).

Maximum population densities of the genus Scenedesmus were observed in the river and middle plume, the counts of a few abundant species often exceeded 50 and at times 300 col/ml. Total quantities found at station EP (1-17 colonies/ml) and in the lake (usually 1-4 col/ml) were disproportionately smaller. Among 17 members of the genus reported from the August collections, most numerous by far were S. abundans (maxima 548 and 451 col/ml in bottom waters at MP and EP respectively) and S. opoliensis (maximum 334 col/ml, at the bottom, MP). The counts of the former species at other sampling depths at stations PP and MP ranged from 78 to 390 col/ml, and of the latter from 45 to 263 col/ml. Minimum numbers of both species noted in deeper water in the lake were 1-2 col/ml. Average populations of S. quadricauda in the

river and middle plume were identical ca. 67 col/ml. Quantities found at EP and in the lake ranged 2-11 col/ml. Scenedesmus incrassatulus was common at PP (ave. 18 col/ml) and MP (ave. 42 col/ml); it was absent from all other stations, except at the surface at EP (1 col/ml). Two other species were found frequently in samples from the river: S. dimorphus (ave. 24 col/ml) and S. perforatus (ave. 10 col/ml). Both were noted at only few depths at the other stations, in lower abundance (0.6 to 4 col/ml). Except for isolated peaks of a few species as S. acuminatus (19 col/ml, surface MP), S. denticulatus (25 col/ml, bottom MP) and S. bernardii (18-19 col/ml, bottom PP and MP) all the remaining members of this genus were found in small numbers and only sporadically.

Contrary to the species of Scenedesmus which were concentrated mainly in the river and middle plume and which were absent from or rare at EP and in the lake, representatives of the genus Oocystis were often very common at all five stations. Few species, O. solitaria, O. parva, O. lacustris, O. borgei and O. crassa were present in all or most collections. Highest counts of O. solitaria, ca. 149 col/ml, were recorded from the bottom in the river and the surface in the middle plume. Average populations at PP (130 col/ml) and MP (116 col/ml) were of similar sizes and over twice as large as those at EP (51 col/ml); these in turn were about twice as high as in the lake (average at both lake stations, ca. 23 col/ml). Oocystis parva (max. 123 col/ml, at the surface at Lake 1) occurred numerously at most sampling depths--average quantities at Lake 1 (66 col/ml) were greater than at the other stations (ave. 25 to 40 col/ml). Maximum abundance of O. lacustris was found at station EP (ave. 55 col/ml), smaller populations 2-34 col/ml were observed at other sampling depths. Oocystis borgei was common in the middle plume (ave. 33 col/ml) and quite common at 5 meters at Lake 1 (12 col/ml). All remaining counts of this species ranged from 1-7 col/ml. Relatively small numbers of O. crassa (ave. 7-14 col/ml) were noted at all stations.

Few species of this genus were absent from the river; they occurred often in high numbers in the plume area or in the lake. Oocystis gloeocystiformis was only found in the lake collections. The highest quantity, 49 col/ml, was observed at 5 meters depth at Lake 1; the smallest, 8 col/ml, from the bottom at Lake 2. Other counts were quite uniform (22-36 col/ml). Average populations of O. submarina in the middle plume and edge of the plume were identical, ca. 27 col/ml, and somewhat higher than at Lake 1 (20 col/ml). Minimum numbers (ave. 5 col/ml) were noted at Lake 2. Counts of O. pussila at MP, EP and in the lake ranged from 1 col/ml (at three depths of station Lake 2) to 19 col/ml (at the bottom of MP). Oocystis elliptica was noted in few samples from EP and lake in small quantities (1-5 col/ml).

Several species, members of other genera than Scenedesmus and Oocystis were found in large abundance in this month's collections. With some exceptions, they were present at all stations, but the quantities found in the river and middle plume much exceeded those at station EP and in the lake.

Numerous populations of Golenkinia radiata were found at all segments of the water columns at stations PP (ave. 279 cells/ml) and MP (ave. 338 cells/ml), the highest count (519 cells/ml) was recorded from the surface at the latter station. Smaller quantities were noted at EP (ave. 22 cells/ml), Lake 1 (ave. 7 cells/ml) and Lake 2 (1-4 cells/ml).

Cell counts of Ankistrodesmus falcatus in the river and middle plume ranged from 114 cells/ml (at the surface, PP) to 371 cells/ml (at the surface, MP), and at the remaining stations from 1 cell/ml (top waters at Lake 1 and bottom of Lake 2) to ca. 25 cells/ml (at the bottom at EP and Lake 1).

Average concentrations of Crucigenia apiculata in the river (108 col/ml) and middle plume (91 col/ml) were similar. Numbers over ten times smaller were found at station EP (8 col/ml) and still smaller

at Lake 1 (1-6 col/ml). Two other species of this genus C. quadrata and C. rectangularis occurred commonly (2-56 col/ml) at various sampling depths at MP and in the lake, and in lower quantities (1-7 col/ml) at station EP. With the exception of the latter species, found in numbers of 30 col/ml at the bottom at PP, they were absent from the river. Present in bottom waters at station PP (28 col/ml) and MP (3 col/ml) was also C. truncata--it was absent from all other collections.

Very common in the river, except at the surface, and in the middle plume were Closteriopsis longissima (26-84 cells/ml) and Dictyospherium pulchellum (26-93 col/ml). Numbers of both entities found in surface waters at station PP, in the edge of the plume, and in the lake ranged from 1 to 7 units/ml. Only C. longissima was observed in larger abundance (18 cells/ml) at the bottom at EP.

Another phytoplankter, Gloeocystis planktonica was very common in most collections. Average quantities at all stations, except MP (89 col/ml), were remarkably similar (40-46 col/ml). Three members of the same genus, G. gigas, G. vesiculosa and G. major were found in smaller abundance in several samples from the edge of the plume and lake (1-14 col/ml). The last species was common at 1 and 5 meters depth in the middle plume, ca. 38 col/ml.

A large number of other less abundant species of the green algae was found in August. Some of them were present in most samples, some only in those from the river and middle plume, others were absent from the river, rare in the plume area, and common in the lake. Most of these greens were usually found in abundances lower than 10 units/ml, only sporadically were they observed in rather high numbers.

Present in most samples were a few representatives of the genera Coelastrum, Kirchneriella, Lagerheimia, Tetraëdron, Westella and also Nephrocytium agardhianum, Quadrigula lacustris, Mougeotia sp. and Tetrastrum staurogeniaeforme. Maximum abundance of Coelastrum reticulatum (98 col/ml) was found at the surface at station Lake 1. Other counts of this species and of C. sphaericum were much smaller (0.6-30 col/ml).

Members of the genus Kirchneriella, K. elongata, K. lunaris and K. obesa were generally found in low quantities (1-5 col/ml), they were more common (11-19 col/ml) at 6 meters depth at station PP. The last species was also common (19-25 col/ml) at the surface and bottom in the middle plume. Few species of the genus Lagerheimia were noted in small numbers (1-8 cells/ml), only L. ciliata occurred somewhat more numerously (12-14 cells/ml) at 1, 5 and 18 meters at Lake 2. Members of the genus Tetraëdron were common in few samples from the river and middle plume (9-40 cells/ml); only two species T. lunula and T. minimum were observed at all stations, usually 1-5 cells/ml. Westella botryoides and W. linearis were common (11-22 col/ml) in bottom waters at PP, MP and EP. The former species was also common (11-43 col/ml) at both lake stations, especially in the metalimnion. Highest quantities of Mougeotia sp. (9-21 fil/ml), Nephrocytium agardhianum (10-46 col/ml), Quadrigula lacustris (14-19 col/ml) and Tetrastrum staurogeniaeforme (11-65 col/ml) were found in the middle plume and at the bottom in the river. Mougeotia sp. was also common (24 fil/ml) at the bottom at Lake 1. Quantities of all four species found in other samples were much lower (1-8 units/ml).

Occasionally common and present practically only in the river and middle plume were Actinastrum hantzschii (4-30 cells/ml), Tetradesmus smithii (4-19 col/ml), Treubaria setigerum (3-11 cells/ml) and a few species of Pediastrum (1-84 col/ml) especially P. duplex for which the maximum count was recorded at the bottom at MP. Actinastrum hantzschii was absent from all other stations, the remaining algae were noted in very few samples in low abundance (1-2 units/ml).

Present in all or most samples from the lake and occasionally noted in the plume area and absent from the river were: Chlorella vulgaris--mainly in top waters (22-161 cells/ml), Planktospheria gelatinosa (1-9 col/ml), Sphaerocystis schroeteri (1-13 col/ml), and Characium sp. (1-27 cells/ml) which was also noted in the river at the surface (2 cells/ml). Another species, Schizochlamys gelatinosa, was found mainly in surface waters in the plume area and lake (1-19 col/ml).

Isolated higher peaks of green algae which were absent from all or most collections were observed in few instances. Thus an unidentified colonial desmid was found in a very large abundance of ca. 1298 cells/ml, at the bottom at station MP. Excentrosphaera viridis was common (30 cells/ml) at 5 meters depth at MP, and Elakatothrix gelatinosa was noted at all sampling depths (ave. 10 col/ml) at the same station.

All remaining greens, including Franceia droescheri, Desmatractum sp., Dimorphococcus lunatus, Ulotrix sp., Schroederia judayi and several others, were observed sporadically in low abundance (1-9 units/ml).

5. Cyanophyta

In August, blue-green algae comprised between 0.12 percent (at the bottom, PP) and 18.28 percent (at 11 meters, Lake 1) of total phytoplankton. Average concentrations at stations MP, EP and Lake 2, were very similar; 41-53 units/ml, and lower than at Lake 1; 72 units/ml. In the river, members of this group were only found at the bottom (12 units/ml). With the exceptions of stations PP and MP, highest quantities of the blue-greens were found in the upper segments of the water columns.

Among 11 taxa of Cyanophyta included in the August counts, present at the bottom in the river were only Phormidium spp. (7 fil/ml) and Chroococcus limneticus (5 col/ml). Phormidium spp. were also common (19 fil/ml) at the bottom in the middle plume, and were rare (1 fil/ml) in two samples from stations EP (at 1 meter) and Lake 1 (at 11 meters). The latter species occurred in all but one (bottom, Lake 2) collections from the plume area and lake, in quantities usually higher than 4 and smaller than 15 col/ml; highest numbers were found at station Lake 1. Another species of the genus Chroococcus, C. prescottii, was found in much larger abundance, particularly in the epilimnion and metalimnion at both lake stations. Average populations

of this alga increased four- to fivefold from the middle plume (8 col/ml) toward the lake (40 col/ml at Lake 1, and 36 col/ml at Lake 2). The highest count, 69 col/ml, was recorded from the surface at Lake 1. Chroococcus minutus was relatively common at stations MP and EP (1-9 col/ml).

Anabaena spp. were observed in practically all samples from the plume area and lake. Average quantities at stations MP and EP, ca. 6 fil/ml, were higher than in the lake, 2.5 fil/ml.

Highest numbers of Oscillatoria spp. were found in the middle plume (ave. 9 fil/ml). Smaller abundance was observed at EP (ave. 4 fil/ml) and in three samples from the lake (1-3 fil/ml).

Aphanizomenon flos-aquae was noted at a few sampling depths with a maximum of 6 fil/ml, at the bottom in the middle plume.

Occasionally rather common, mainly in the surface waters, and observed only at EP and in the lake were Anacystis spp. (1-13 col/ml), Aphanocapsa spp. (1-15 col/ml) and Microcystis aeruginosa (3-9 col/ml).

6. Chrysophyta

This group of algae comprised at most 1.23 percent of total phytoplankton (at 18 meters, Lake 2).

Dinobryon divergens was found at all stations, with highest numbers, 7-13 cells/ml, in bottom waters in the plume and lake.

Mallomonas spp. were common in deeper water in the river (ave. 30 cells/ml) and middle plume (ca. 24 cells/ml); they were not found in the 1 meter samples from either station. Small numbers (1-3 cells/ml) were noted in a few collections from EP and lake.

Ophiocytium sp. was rather numerous in the river and middle plume (4-21 cells/ml) with highest concentrations at the bottom at PP and surface at MP.

7. Pyrrophyta

Pyrrophyta made up between 0.34 percent and 5.36 percent of total phytoplankton.

<u>Peridinium</u> spp. were found in large abundance in the river (ave. 148 cells/ml) and middle plume (ave. 177 cells/ml). The two highest counts were recorded from the surface at MP (327 cells/ml) and at 5 meters depth at PP (263 cells/ml). Average quantities in the edge of the plume were much smaller (27 cells/ml) though still higher than in the lake (ca. 4 cells/ml).

<u>Glenodinium</u> spp. were concentrated mainly at 1 and 5 meters depth in the river and middle plume (5-46 cells/ml), and <u>Cystodinium</u> sp. was quite common (ca. 11 cells/ml) at the level of the thermocline at the same stations.

Small numbers of <u>Ceratium hirundinella</u> were noted in collections from EP and Lake.

8. Flagellates

Total quantities of flagellates found in August varied from 1 cell/ml (at 11 meters of station Lake 1) to 705 cells/ml (at the surface in the middle plume). Zero count was found in the 5 meter sample at Lake 2.

Average populations of <u>Cryptomonas</u> sp. decreased drastically from the river (304 cells/ml) and middle plume (265 cells/ml) toward the edge of the plume (27 cells/ml) and Lake (Lake 1 15 cells/ml, and Lake 2 3 cells/ml). Maximum count, 501 cells/ml, was found at 5 meters at station PP.

In the river, <u>Chlamydomonas</u> sp. was only found at the bottom (67 cells/ml). Largest quantities of this phytoplankter were observed at 1 and 5 meters depths in the middle plume, 195 and 100 cells/ml respectively. Rather numerous populations were found in bottom waters at stations MP and EP, and also at the surface at Lake 1 (28-33 cells/ml). Quantities noted in a few other samples from EP and lake were low (2-12 cells/ml).

<u>Euglena</u> spp. were very common in deeper water in the river (ca. 51 cells/ml), and were less abundant at the surface at MP (28 cells/ml). Smaller numbers were found in a few other depths from the same stations and also from EP (3-11 cells/ml).

Pteromonas sp. were relatively common at 5 meters depth and at the bottom in the river and middle plume; 9-17 cells/ml.

J. General Summary of Monthly Data

Monthly differences in physiochemical conditions and in phytoplankton compositions are shown as changes from the river toward the inshore lake. Descriptions of physical and chemical data characteristic of each month are followed by detailed analyses of the phytoplankton. Numerical abundances of total phytoplankton are related to the levels of silica, phosphate and nitrate. Dominant and common species of algae, representatives of different groups--Bacillariophyta, Chlorophyta, Cyanophyta, Chrysophyta, Pyrrophyta and Flagellates--(the latter group included entities of uncertain systematic position) are described in order of decreasing numerical abundance.

There were rather pronounced differences between the areas of studies--the river, the middle of the river plume, the edge of the plume and the inshore lake waters--in the physiochemical conditions and in the abundance and quality of the phytoplankton. The average chemical and physical results are summarized in Table 7. Table 8 shows the average numbers and ranges of numbers of major algal groups and dominant diatoms at each study area.

During each month the average values of various chemical parameters measured--orthophosphate, nitrate nitrogen, silica, chloride, sulfate, total alkalinity, carbon dioxide--were higher in the river than in the river plume area and much higher than in the inshore lake. In general, considerable decline of these values was found from the river toward the middle of the plume and then a less pronounced decrease toward the edge of the plume and lake.

The pH results were either similar in all areas or higher in the river.

Concentrations of dissolved oxygen were usually lowest in the river and highest in the lake or in the edge of the plume.

The ranges of values of most chemical substances measured, especially of silica, nitrate nitrogen, orthophosphate and dissolved oxygen were greater in the river or in the river plume than in the lake.

The water temperature readings indicated that the river was slightly colder than the inshore lake in October and November, and warmer or much warmer during the remaining months in the spring, summer and early fall.

Secchi disc transparencies increased from the river toward the lake. The average percent transmission of the surface light intensity at the Secchi disc depth also increased from the river toward the lake.

The typical color of the river water as seen above the white Secchi disc was brown or yellow-brown, it was usually lighter-yellowish-brown, or yellowish-green in the plume area, and again lighter, usually green, in the lake.

Turbidity values were highest in the river and lowest in the lake.

The average yearly abundances of total phytoplankton were more than fivefold greater in the river than in the inshore lake area. Intermediate numbers were found in the river plume; they were higher in the middle of the plume than in the edge of the plume. These differences in algal numbers appeared to be related to the different levels of phosphates, nitrates and silica.

Inhibition of diatom growth was evident in surface waters in the lake during the summer and early fall. Low numbers of diatoms coincided with a depletion of phosphate, nitrate and silica.

The physical and chemical parameters measured, as well as the phytoplankton results, suggest that the lower Grand River is more productive or eutrophied to a higher degree than the adjacent inshore waters of the lake. The river plume region, where intermediate values of productivity related parameters were found (nutrients, Secchi disc transparency, standing crop of phytoplankton) also appears to be more productive than the inshore lake waters.

Diatoms comprised the majority of the phytoplankton numbers in each area, except in the lake in August when greens and other algae dominated the flora. Centric diatoms of the genera Cyclotella, Melosira and Stephanodiscus were the predominant algae in the Grand River and in the river plume. In the inshore lake, pennate diatoms

were usually more abundant than the centrics; Fragilaria crotonensis and Tabellaria fenestrata were the principal species.

The river phytoplankton was at all times dominated by diatoms typical of highly eutrophic waters; Cyclotella meneghiniana v. plana, Melosira granulata v. angustissima, Melosira granulata, Stephanodiscus hantzschii, S. tenuis, S. subtilis. The riverine species were usually present in high numbers in the river plume and in smaller numbers in the lake. Particularly, the three first named species, which occurred in highest abundance during the summer and fall, comprised a significant portion of the flora in the plume and lake. On the other hand, several species abundant or common in the lake and in the river plume, especially during the spring, were absent from the river or present there in small numbers. The absence from the river, or presence in small quantities, of such species as Stephanodiscus transilvanicus, Melosira italica subsp. subarctica, Synedra ulna v. chaseana, Cyclotella ocellata or such as Tabellaria fenestrata and Melosira islandica was not unexpected, since those diatoms are offshore dominants in Lake Michigan, and the first four species are considered as oligotrophic types (see Stoermer and Yang, 1970). However, the absence from the river of Stephanodiscus binderanus, or the sporadic occurrence of Diatoma tenue v. elongatum, Diatoma tenue v. pachycephala, Fragilaria capucina, F. capucina v. mesolepta and Cyclotella pseudostelligera--which are typically found in eutrophic or highly polluted areas--was somewhat surprising. The qualitative differences of phytoplankton between the river on one hand, and the river plume and the lake on the other, can be apparently attributed not only to the differences in the level of essential nutrients, but most probably also to the differences in concentrations of various other chemical substances such as chloride, calcium or sulfate. The influence of conservative elements on species distribution, and particularly the importance of chlorides has been long recognized (see Lund, 1965; Patrick and Reimer, 1966; Patrick, 1948; Cholnoky, 1968). The differences in the temperature regimen of the river and the lake, and perhaps also the very difference between

the lotic habitat of the river and the lentic habitat of the lake were most likely also significant in influencing the species distribution. While the Grand River is undoubtedly an important source of many phytoplankters for the inshore lake, its main role appears to be in modifying the chemical conditions of the inshore lake waters.

During practically all months highest numbers of phytoplankton taxa were noted in the river plume area--this evidently reflected the mixing of the river phytoplankton with the lake phytoplankton. It may suggest also that the plume area is a region of particularly favorable nutritive conditions for many species. Lowest numbers of species were generally found in the lake.

Compared with diatoms, other algae were found in much smaller numbers; among those most abundant were greens and flagellates. The greens and blue-greens dominated the flora during August in the lake, when the growth of diatoms was apparently inhibited by depletion of nutrients.

Seasonal variations of phytoplankton in each of the four areas of studies, and correlations of numerical abundances of algae with physical-chemical factors are discussed in the next chapters.

V. SEASONAL CHANGES IN ABUNDANCE OF TOTAL PHYTOPLANKTON AND TOTAL DIATOMS

In all areas of the studies--the river, the middle plume, the edge of the plume and the inshore lake--diatoms comprised on the average a high percentage of total phytoplankton; 83.84% at PP, 77.92% at MP, 76.96% at EP and 75.38% at Lake. Average quantities of total phytoplankton and diatoms were higher in the river (9073 units/ml and 7607 cells/ml, respectively) than in the middle plume (4761 units/ml and 3710 cells/ml), and much higher than in the edge of the plume (2692 units/ml and 2072 cells/ml) and in the lake (1682 units/ml and 1268 cells/ml). Among phytoplankters other than diatoms, only green algae and flagellates were found in substantial numbers at the four areas.

A. The Grand River

1. Phytoplankton Fluctuations

In the river, high cell numbers of total phytoplankton and diatoms occurred during all periods of sampling (average diatom counts were above 4800 cells/ml) except in March (average diatoms 1300 cells/ml). Highest quantities in surface waters were observed during summer in June and July, and during fall in September and October. Two distinct peaks of average numbers--in July (all algae 14468 units/ml, diatoms 12719 cells/ml) and in October (all algae 15958 units/ml, diatoms 14230 cells/ml)--were caused partly by particularly large populations found at the bottom (see Figures 11a,b,c)

Seasonal variations of total flora reflected mainly the fluctuations of centric diatoms, especially of Cyclotella meneghiniana v. plana, Melosira granulata v. angustissima and M. granulata which occurred in high numbers and dominated the phytoplankton during the summer and fall (Tables 1 and 2). In spring, at the time when these

three diatoms were found in lowest abundance, C. meneghiniana v. plana was still one of the principal plankters, although the two species of Melosira were greatly exceeded in numbers by Stephanodiscus hantzschii, S. minutus, S. subtilis and S. tenuis. Both S. hantzschii and S. minutus were found in highest quantities in April and declined sharply to low numbers in July and August. Stephanodiscus hantzschii was also present in low abundance during the fall. Stephanodiscus subtilis and S. tenuis were abundant during all months and showed two maxima, in May and in October. In March, when the total flora was at the lowest level, the two species were the major dominants together with C. meneghiniana v. plana. A few other centric diatoms were characteristic in the plankton during most months and at times were found in rather high numbers. Thus Cyclotella stelligera and Coscinodiscus subsalsa were very common during the fall, and the latter species also in the summer; Stephanodiscus astrea was abundant in June and October; Melosira varians in May, June and July; and Stephanodiscus alpinus in July. Certain species occurred abundantly only during single periods of sampling: Melosira islandica was conspicuous in the July flora, and Cyclotella comensis, C. cryptica, C. striata and Coscinodiscus sp. were very common in August.

Pennate diatoms were always present in much smaller relative abundance than the centrics (Table 2); however a few species reached particularly high numbers at various times. Asterionella formosa was very common in the late spring and early summer and Fragilaria crotonensis was abundant during the summer, with higher numbers in deeper waters. Several species which were most probably derived from benthic communities were common and conspicuous in the flora. These were: Fragilaria construens, F. brevistriata, F. pinnata, Navicula decussis, N. tripunctata, N. cryptocephala, N. viridula, Nitzschia sp. #2, Nitzschia dissipata, Synedra ulna, Diatoma vulgaris, Gomphonema olivaceum, Rhoicosphaenia curvata, Achnanthes lanceolata v. dubia and Amphora ovalis v. pediculus. The species of Fragilaria and Nitzschia, Rhoicosphaenia curvata and A. lanceolata v. dubia were more abundant

during the summer than in other seasons, while the species of Navicula, Synedra ulna, Diatoma vulgaris and Gomphonema olivaceum were especially common in the spring. Abundant in the summer but absent during the spring and fall were: Nitzschia woltereckii, Synedra ulna v. spathulifera and S. ulna v. oxyrhynchus. Cocconeis placentula v. euglypta was characteristic of the late summer and early fall, and Achnanthes clevei and Fragilaria voucheriae v. truncata were common in the spring.

Seasonal fluctuations of some of the benthic species are apparently similar in distinctly different bodies of water. Spring peaks of S. ulna, D. vulgaris, G. olivaceum and N. viridula were observed by Rice (1938) in the River Thames. Jørgensen (1957), who studied epiphytic diatoms on Phragmites stems in two eutrophic Danish lakes, also observed that S. ulna, D. vulgaris, G. olivaceum and Navicula cryptocephala dominated in winter and spring.

In the present study green and blue-green algae occurred in highest quantities in the summer and early fall; during this period the numbers fluctuated moderately and no distinct peaks were noted. Flagellates were abundant in March and June, Chrysophyta were common in late spring and summer, and Pyrrophyta in July and August.

2. Correlations with Physical-Chemical Factors

Seasonal variations in phytoplankton abundance appeared to be associated with fluctuations of nutrients, silica and temperature (Figures 11a-11f). It appears also that nutrients and silica were not limiting to the algal growth. Phosphate (ave., 68.9 ppb, range 38.6-107.0 ppb), nitrate nitrogen (ave., 450 ppb, range 20-1200) and silica (ave., 4.43 ppm, range 0.62-8.25 ppm) were found in rather high supply during most periods of sampling (see also Tables 6e,6g,6h). Only nitrates were low in August (ave. 30 ppb); however these concentrations did not seem to have limited the numbers of algae as observed at the periods of study. Lund (1950) stated that some species of diatoms are able to utilize inorganic nitrogen at concentrations

below 0.1 mg N/liter. The amounts of silica were always higher than those associated with decreased diatom growth elsewhere (0.5 ppm SiO_2--Pearsall, 1932; Lund, 1950) and much higher than concentrations which are considered to be limiting for diatoms (about 0.08 ppm--Jørgensen 1957, or lowest detectable in nature--Lewin and Guillard, 1963). The values of phosphate were greater than those which are likely to promote algal blooms (30 ppb--Sawyer, 1947). Apparently very little phosphorus is needed by algae. According to Mackereth (1953) 1 ppb P/l should be sufficient to produce 16000 cells/ml of Asterionella.

Phytoplankton maxima during summer and fall coincided with a considerable decrease of the amounts of silica and nitrate nitrogen indicating a biological uptake of these chemicals from water. Lowest values of silica were observed in July (ave., 2.01 ppm) and September (ave., 0.65 ppm). The corresponding concentrations of nitrate were 266 ppb in July and 226 ppm in September. Phosphate, in spite of variations, was always abundant which suggests that it might have been the major nutrient stimulating the high growth of phytoplankton. (Positive correlations of numerical abundances of algae with orthophosphate and negative correlations with silica and nitrate are discussed in Section VI.) Considerable decrease of phosphate from March to May can be attributed to the uptake by rapidly growing phytoplankton, and the rise to high levels in summer and fall resulted probably from increased organic decomposition. Summer increases in dissolved inorganic phosphate are apparently common in rivers (Blum, 1956, 1957).

Highest numbers of phytoplankton were found in warmer months and corresponded with a temperature range between 16°C in October and 27°C in July. Rice (1938) and Schroeder (1939) observed that warm water favors the growth of Cyclotella meneghiniana and Melosira granulata, diatoms which I found--especially their varieties, C. meneghiniana v. plana and M. granulata v. angustissima--to be the major dominants in the Grand River. Whitford and Schumacher (1963) reported that M. granulata v. angustissima is the principal alga in warm large rivers

of North Carolina where it reaches maximum abundance during the summer months. Abundant summer growth of C. meneghiniana has been recently observed in two English rivers, the Severn and the Stour (Swale, 1969). Summer and early fall maxima of C. meneghiniana and M. granulata have been reported also from eutrophic areas of the Great Lakes; M. granulata is very common in nearshore areas on the eastern side of Lake Michigan (Stoermer and Yang, 1970), and in Green Bay (Holland, 1969; Stoermer and Yang, 1970) and both species are abundant in Lake Erie (Hohn, 1969).

Undoubtedly the effects of temperature on phytoplankton growth cannot be separated from the effects of light since both factors increase together and both are interrelated in photosynthesis. The enhanced growth of the flora in the Grand River from March until July can be attributed to the increasing temperature and increasing light during the longer spring days. Lowest numbers of phytoplankton in March, when nutrients and silica were in highest concentrations, suggest that both low temperature and insufficient light inhibited the growth of algae in winter when the river was covered with ice. Lund (1964) stated that low light and temperature are the factors which determine winter minimum of algal growth. An increase in day length during the spring, and thus increase in illumination, is the most likely factor to initiate an outburst of algal growth (Lund, 1964, 1965).

It seems then that the seasonal changes in numbers of phytoplankton in the Grand River resulted chiefly from the changes in temperature, while the effects of incident light were particularly important during the spring and early summer months when the highest increase of algae was observed. Good illumination is apparently important for the growth of C. meneghiniana. Rice (1938) stated that increased light favored development of this species in the River Thames. Jørgensen (1964) found in laboratory experiments that the rate of photosynthesis of C. meneghiniana was not inhibited at very high light intensities of 60 or 100 Klux while inhibition of growth of another alga, Chlorella vulgaris was evident at 30 Klux.

Nutrients and silica in the river appeared to be in a sufficient supply to maintain high numbers of phytoplankton and it seems unlikely that the fluctuations in nutrient or silica concentrations were affecting the seasonal changes in the flora. In other words, it appears that the concentrations of silica, phosphate or nitrate as observed in this study were not limiting the growth of the total phytoplankton. However, more frequent sampling, especially in summer and early fall and continuation of sampling in the fall of 1969 might have revealed smaller numbers of phytoplankton as well as lower concentrations of silica than those noted in September (minimum 0.62 ppm) and lower values of nitrate nitrogen than found in August (minimum 20 ppb). Since phosphate content of the Grand River is very high (higher concentrations than in this study--usually in excess of 100 ppb--have been reported by the Michigan Grand River Watershed Council (1972) and Ayers (1970) gave a figure of 520 ppb of total soluble PO_4 as an average concentration in the Grand River), it seems highly probable that both silica and nitrate, and particularly nitrate may become depleted in these waters following periods of maximum phytoplankton growth. High content of inorganic nitrogen might be necessary for abundant growth of _C. meneghiniana_ and _M. granulata_. Cholnoky (1968) stated that _C. meneghiniana_ has its optimum in nitrogen rich waters although it appears to be also a facultative nitrogen heterotroph. Rice (1938) found that the occurrence of _M. granulata_ in the Thames was correlated with a high percentage of nitrate. On the other hand, according to Hustedt (1939) _M. granulata_ prefers a low nitrate-phosphate ratio, as it develops after the nutrients are depleted from water. Kofoid (1903, 1908) also found maxima of _M. granulata_ in the summer plankton of the Illinois at a time when nitrates were very low.

3. Comparisons with Other Studies

Reports by various investigators indicate that there can be wide variations in the patterns of seasonal changes of river

phytoplankton (Blum, 1956). In some highly enriched rivers of England, as in the Lee (Swale, 1964) or in the Thames and the Kennet (Lack, 1971), diatom maxima occur during spring and fall, as is the case in small temperate lakes. Results of several extensive river studies in North America [as in the Sacramento (Greenberg, 1964), the Montreal (Cushing, 1964), and many rivers in North Carolina (Whitford and Schumacher, 1963)] and in Europe [in the Danube (Enaceanu, 1964) and in the Severn and the Stour (Swale, 1969)] showed that highest development of algae occurs during the warm months of the year. Hynes (1970) reviewed many data pertaining to the ecology of river algae and observed that maximum numbers of phytoplankton are almost always reported during summer or early fall and minimum in winter.

Various authors have stated that temperature is the determining factor in seasonal distribution of phytoplankton although other factors as nutrients, light or current velocity may also be very important (Kofoid, 1908; Allen, 1920; Coffing, 1937; Wundsch, 1920; Greenberg, 1964; Whitford and Schumacher, 1963). The rate of flow seems to be the most important factor affecting diatom growth in a few English rivers, where highest numbers are invariably correlated with periods of low discharge (Rice, 1938; Swale, 1964; Swale, 1969; Lack, 1971).

Diatoms were the dominant algae in the Grand River. Apparently diatoms constitute the largest planktonic group in almost all rivers of the temperate zone (Hynes, 1970). It appears also that centric diatoms usually dominate the river phytoplankton, (Swale, 1969). Species of centrics which were the principal algae in the Grand River are frequent and often abundant components of plankton in major rivers of the United States (see Williams and Scott, 1962; Williams, 1964). *Melosira granulata* is characteristic of the Ohio River, *Stephanodiscus hantzschii* of the Illinois and of the upper Mississippi, *Cyclotella meneghiniana* is abundant in the Rio Grande, the Red, and in portions of the Mississippi (Williams and Scott, 1962). In Europe *C. meneghiniana* and *S. hantzschii* have been reported from the Danube (Wawrik, 1962) and the Weser (Lemmermann, 1907), *C. meneghiniana* and *Stephanodiscus*

tenuis in large abundance (maximum 46000 cells/ml) from the Severn and the Stour (Swale, 1969), and S. hantzschii in great numbers (max. of centric diatoms 67520 cells/ml) from the Thames (Lack, 1971) and the Lee (max. 40100 cells/ml) (Swale, 1964).

Numbers of phytoplankton which I found in the Grand River (maximum total algae 18939 units/ml; max. diatoms 16941 cells/ml; max. C. meneghiniana v. plana 8935 cells/ml, see also Table 8) are clearly of the order of those in various other North American rivers, especially these with a considerable nutrient enrichment (see Martin and Weinberger, 1966; Palmer, 1964; Williams and Scott, 1962). Studies of rivers in the United States between 1961 and 1963 by the Water Pollution Surveillance System of the Public Health Service showed that about one half of 130 sampling stations had an average counts of at least 10000 algae/ml (Martin and Weinberger, 1966). It is of interest that phosphate content in the waters at about 77 percent of the same stations was at least 100 ppb. Concentrations of phosphate in the Grand River were almost always lower than this figure but were at least 38.6 ppb. Palmer (1964) reported that many phytoplankton counts from American rivers over the period of 1957 to 1960 were in the range of 1000 to 5000 cells/ml and one half of the highest numbers in 15 rivers ranged from 21480 cells/ml (the Yellowstone River) to 101200 cells/ml (the Arkansas). Low numbers of phytoplankton have been repeatedly observed in the Michigan's Detroit River. Wujek (1967) gave an average of 500 cells/ml as representative of the entire river over a period of 1962 to 1963. Similarly low counts have been found by Vaughan and Harlow (1965), Williams and Scott (1962) and by the Michigan Water Resources Commission (1970). Presumably low numbers in this river and equally low numbers in the St. Clair River (Michigan Water Resources Commission, 1970) reflect the small algal populations of Lake Huron whose waters enter both rivers. On the other hand, the Detroit River receives large loads of industrial wastes, perhaps containing materials which are toxic to algal growth.

It has been observed that large algal populations can be quite localized, they can be characteristic of a single station (Claus, 1961; Williams and Scott, 1962), or they can occur only in portions of a river (Palmer, 1964). Thus the high numbers of algae found in the Grand River opposite the Grand Haven Municipal Power Plant may be representative only of the lower reaches of this river. This seems very likely since, as stated by Hynes (1970), numbers of phytoplankton generally increase downstream, a phenomenon which is probably conditioned by the age of water: "the older the water the greater is the chance of its having acquired both drift and truly planktonic organisms," but--"much must depend on local conditions."

B. The Lake

1. Phytoplankton Fluctuations

In the inshore lake waters (Figures 12c,e,g) peak numbers of total phytoplankton and total diatoms were found in the early spring with highest average counts in April (total algae 3300 units/ml, total diatoms 2820 cells/ml). Relatively high densities were noted also in June (ave. total algae 2330 units/ml, ave. diatoms 1910 cells/ml). Generally, however, the numbers decreased gradually after April to a minimum in August (ave. total algae 770 units/ml, ave. diatoms 300 cells/ml), when diatoms were almost entirely absent from the upper parts of the water columns (total diatom counts at 1, 5 and 11 meters ranged 2 to 32 cells/ml) and the flora was dominated by green and blue-green algae.

Low numbers, similar to those in August, and high numbers comparable to those in the spring, were found in September of 1968 at two stations separated by a distance of 2 km. The station with small counts (Lake 1) was located farther from shore (2 km) not in the direction of the flowing river plume, and the surface waters contained low, probably limiting, silica concentrations (0.32 ppm), which were characteristic also in the summer of 1969. The station

with high numbers (Lake 5) was located closer to the shore (0.8 km), in the direction of the plume and had silica concentrations about twice as high.

Diatoms comprised the majority of the total phytoplankton numbers during all months except in August (Tables 1 and 2). Centrics dominated the flora during the spring maximum and at both stations in September. At other times pennates were present in usually much higher relative abundance than the centrics. Different species of the centric diatoms became conspicuous in the plankton at various times, showing well-marked seasonal fluctuations. Stephanodiscus alpinus, S. transilvanicus, Melosira islandica and to a smaller degree Cyclotella ocellata and S. minutus were abundant in March and April. The numbers of S. alpinus, S. transilvanicus and C. ocellata declined drastically in May and continued to be present at low levels during all other months. M. islandica and S. minutus were absent in the fall. Stephanodiscus hantzschii, which was usually present in small quantities, became abundant in April and May. Melosira italica v. subarctica showed a small peak in April, and Stephanodiscus binderanus was very common in May. Melosira granulata v. angustissima and M. granulata were relatively rare in the spring, rose to higher numbers in June, and assumed dominance among the centrics in deep waters in August and during the fall. Only in September at station Lake 5 were both species exceeded in numbers by Cyclotella meneghiniana v. plana. This entity was absent from the plankton only in March; during all other months it was relatively common, with a peak abundance in the early fall. Other centrics characteristic in the flora were: Cyclotella michiganiana and C. kützingiana which were common in the fall, Stephanodiscus tenuis and Cyclotella stelligera which were common in the spring, C. operculata which was very numerous in July and Rhizosolenia eriensis, common in May.

Among the pennate diatoms which were generally more abundant than the centrics, Fragilaria crotonensis and Tabellaria fenestrata were dominant species common or very common during all periods of sampling. Numbers of the first named species fluctuated moderately

and high concentrations were found in November and also in deeper waters in July and August. Tabellaria fenestrata showed a continuous rise from March to a summer peak in June and July. This rise was succeeded by a decrease in bottom waters in August and the lowest quantities were found during the fall. Both species were the major diatoms in the summer flora, especially in deeper water, and F. crotonensis was the principal alga in October and November. Fragilaria capucina was fairly abundant during all months except in September when it was practically absent from the plankton. It was one of the dominants at the time of its highest concentrations in May, June, October and November. Fragilaria capucina v. mesolepta and F. capucina v. lanceolata were characteristic in May and June. Very common in the spring and early summer were Synedra ulna v. chaseana, S. ulna v. danica, S. delicatissima v. angustissima which showed peaks in April, and also Diatoma tenue v. elongatum and D. tenue v. pachycephala both with a peak in June. The species of Synedra and D. tenue v. elongatum were usually present during other months in low quantities. Nitzschia sp. #2, an entity first reported by Stoermer and Yang (1969), occurred in high numbers in the early spring in March and April when it comprised about 80 percent of the total numbers of Nitzschia. Asterionella formosa was quite common during most sampling periods but never reached a definite peak. Somewhat higher numbers occurred in the spring and fall especially in November. Smallest quantities were noted in August and September (at station Lake 1) at the time when total diatoms were found at lowest levels.

Most of these diatom species have been previously reported from the inshore waters near Grand Haven (Figures 1 to 44 in Stoermer and Yang, 1970; Stoermer, 1968). Many of them, particularly the forms commonly found in eutrophic waters elsewhere (Stephanodiscus hantzschii, S. binderanus, S. alpinus, S. tenuis, M. granulata, Cyclotella meneghiniana, Fragilaria capucina, F. capucina v. mesolepta, Diatoma tenue v. elongatum and others) are becoming increasingly abundant in

various inshore parts of Lake Michigan, especially in the southern and eastern areas or in Green Bay (see also Stoermer and Yang, 1969; Holland, 1968, 1969). Some, e.g., Stephanodiscus binderanus have been observed to develop in such numbers as to cause problems with short filter runs at the Chicago water filtration plants (Vaughn, 1961). Spring blooms of S. hantzschii were noted near Chicago as well as in offshore waters of the southern basin of Lake Michigan (Stoermer and Kopczynska, 1967). Most of the eutrophic species referred to above are the present major diatoms in Lake Erie--the most eutrophied of the Great Lakes (Hohn, 1969).

Among phytoplankters other than diatoms, green algae were present in low and constant numbers throughout most of the year and reached a peak in August. Blue-greens were less common than the greens particularly during the periods of their maxima in June, August and September. Flagellates were abundant in the spring and late fall and declined to low numbers during the summer. Chrysophyta were very common in July and September (at station Lake 5), and Pyrrophyta were usually uncommon except for somehwat higher numbers in April (see Table 3).

2. Correlations with Physical-Chemical Factors

It appears that the seasonal changes in abundance of phytoplankton and most probably also the seasonal succession of species in the inshore lake waters were chiefly associated with the availability of nutrients and silica (see Figs. 12a to 12g). Physical factors such as light and temperature were probably also important particularly in the spring when increasing incident light seems to be the most likely factor to promote algal growth (Lund, 1965).

High numbers of total algae and total diatoms in the early spring corresponded with the highest observed concentrations of silica (range 1.50 to 2.55 ppm), nitrate nitrogen (range 170 to 490 ppb) and orthophosphate (usually 9.1 to 18.5 ppb), see also Tables 6e, 6g and 6h. There was a considerable decrease of the chemical values in May particularly in surface waters which coincided with a significant drop

of algal counts (Figs. 12d,e). Samples were not taken during six weeks between April and May and it is highly possible that a peak of phytoplankton was missed, since the decline in nutrient concentrations in this period was probably reflected by a further increase in the numbers of algae. Low values of nutrients and silica at the surface and often in deeper waters were maintained during the subsequent periods of sampling in June, July and August, and coincided with a general decrease of diatom counts. The same situation, low nutrient values and small numbers of algae, was observed in September of 1968 at station Lake 1.

Inhibition of diatom growth--judging by the low numbers--was evident in surface waters in midsummer and early fall, especially in August (see Fig. 12e and Table 1). The average silica values in upper parts of the water columns in June, July, August and September (at station Lake 1) were 0.33 ppm. The corresponding average values of nitrate nitrogen were ca. 73 ppb. The average orthophosphate values from all sampling depths in May, June, July and August were about 0.5 ppb--in many cases orthophosphate could not be detected. It appears that any one of these nutrients, or perhaps all of them were in an insufficient supply and thus limiting for diatoms. In dealing with this group of algae one considers first of all the possibility of growth limitation by silica, since silica is necessary for diatom multiplication (Lewin; 1961, 1962). Concentrations of 0.30 ppm SiO_2 are probably not limiting since several authors (Jørgensen, 1957; Hughes and Lund, 1962; Lewin and Guillard, 1963; Lund, 1964, 1965) seem to agree that the cessation of diatom growth at silica concentrations higher than the lowest detectable in nature may be attributed to inhibition by other nutrients or other factors. If other nutrients are present in water in adequate amounts, essentially all of silica can be incorporated by diatoms. Works with diatom cultures and experiments with natural populations of diatoms (Hughes and Lund, 1962; Lund, 1969) as well as observations in nature (Lund, 1969) have shown that phosphate may often be such a general limiting nutrient preventing efficient utilization of silica. In the summer and early fall of 1969 and 1970

Schelske and Stoermer conducted nutrient enrichment experiments with phytoplankton assemblages in situ in Lake Michigan and came to a similar conclusion (Schelske and Stoermer, 1972). They found that additions of small amounts of phosphate into large plastic bags containing natural populations of phytoplankton stimulated the growth of diatoms and other algae and as a result silica was reduced to limiting levels of about 0.05 ppm. Parts of these experiments were conducted at inshore and offshore stations in the vicinity of Grand Haven (Stoermer, Schelske and Feldt, 1971) only a few kilometers from my stations and some of them were performed on the same days in July and August on which I collected my samples. The values of silica and nitrate nitrogen which I observed during the summer were similar to those which they found in lake water, especially at their inshore station (Schelske, Stoermer and Feldt, 1971). The species composition of phytoplankton and the numbers of cells which I found were also similar to their results from the inshore station. Thus in view of the nutrient experiments results obtained by Stoermer and Schelske in the Grand Haven area it appears that phosphate was probably the major limiting nutrient in waters at my inshore lake stations.

On the other hand, when the possibility of growth limitation by silica is concerned it is always important to consider the composition of diatom species present in the plankton since undoubtedly various species have different silica requirements, and some such as Melosira italica subsp. subarctica seem to be limited by concentrations of 0.8 ppm (Lund, 1954, 1955, 1965) while others as Stephanodiscus astrea have been observed to develop when silica falls to very low levels (see Kilham, 1971). It appears that silica concentrations of about 0.30 ppm typical in surface waters during the summer could be limiting per se for Melosira granulata and Cyclotella meneghiniana, species, which although they were present in relatively small numbers, comprised a significant part of the summer--early fall diatom flora. Kilham (1971) examined many data from literature concerning diatom-silica relationship and observed that there are strong

correlations between the numerical abundance of M. granulata and of a few other diatom species and the concentrations of silica in the water. On this basis he hypothesized also that declining ambient silica may influence the seasonal succession of diatoms; according to him, high numbers of M. granulata are consistently found in waters of high silica content with a mean concentration of 13.4 ppm, and only very small populations--probably suspended by turbulence--occur when silica decreases to less than 1.0 ppm. He also cites the work of Moss (1969) who observed that in Abbot's Pond (England) Cyclotella meneghiniana and A. formosa were replaced by S. astrea at a time when silica declined below 0.3 ppm. In view of Kilham's observations it may well be that the presence of M. granulata and C. meneghiniana in the inshore lake waters with such low silica content is explicable mainly by the influence of the inflowing river water. Both species occurred in very high numbers in the summer and fall flora in the Grand River. Both species were also included among dominant taxa reported by Schelske, Stoermer and Feldt (1971) from their inshore station located in the area of the Grand River outlet, however they were absent from or present in much smaller numbers at an offshore station. The offshore station was characterized by generally lower silica values than the inshore station which in turn had chemical values similar to those at my inshore lake stations.

Other species, such as Fragilaria crotonensis and Tabellaria fenestrata which were actually more numerous in the summer plankton are perhaps able to thrive more effectively on lower silica concentrations, since they are typically found in nutrient poor oligotrophic waters (Hutchinson, 1967). In Lake Michigan F. crotonensis and T. fenestrata are major plankton diatoms and both species have been observed to be capable of thriving in a wide variety of trophic levels (Stoermer and Yang, 1970). According to Lund (1965) F. crotonensis and T. flocculosa may have lower silica requirements than M. italica subsp. subarctica. If M. granulata behaves like M. italica, as suggested by Kilham (1971), and T. fenestrata like T. flocculosa--both species are typical of

oligotrophic waters (Teiling, 1955; Rawson, 1956) and both are found in the same phytoplankton associations in Lake Michigan (Stoermer and Yang, 1970)--it is conceivable that T. fenestrata and F. crotonensis require lower silica concentrations than M. granulata.

As mentioned earlier the average concentrations of nitrate nitrogen in surface waters during the summer were about 70 ppb. If nitrate was not limiting most of the time, it was probably not sufficient in August at station Lake 1 where the average concentrations were 20 ppb, and no nitrate was detected at the depth of 5 meters (Table 6e).

Orthophosphate usually could not be detected and as Kuenzler and Ketchum (1962) have stated, the fact that one is not able to measure phosphate by ordinary chemical methods is not a proof that it is limiting algal growth, however, the evidence that phosphate was limiting at this time and in this area was provided by the nutrient enrichment experiments of Stoermer and Schelske. Another indication that phosphate was in a short supply could perhaps be the presence of large populations of Dinobryon divergens observed in July. This alga presumably prefers very low concentrations of phosphorus; moreover, it appears to be inhibited by higher levels optimal for many other species (Hutchinson, 1967).

The inhibition of diatom growth in the summer--especially in August--may also perhaps be attributed to toxic effects of Anabaena, which was present in practically all samples in July and August. Stoermer et al. (1971) observed during their experiments at an inshore station in July that phytoplankton cells declined considerably in bags containing senescent populations of Anabaena flos-aquae. They suggested that the rapid decrease of numbers of algae which they noted might have been caused by inhibitory substances secreted by Anabaena.

It appears then, that the shortage of any one of the three nutrients measured and perhaps also other factors as the possible toxic effects of blue-green algae could have all contributed to the inhibition of diatom growth in the summer and early fall. However, it may well be that phosphate was the major limiting factor which prevented efficient utilization of silica and nitrate by diatoms. As Lund (1964) has stated

in his discussion of phytoplankton periodicity in the English Lake District "...the level at which silica limits the growth of these diatoms apparently also depends on other factors, for example, on the phosphate concentration" and thus "in nature we are largely dealing with relative limiting factors or with groups of factors, all of which are to some extent limiting."

As pointed out at the beginning of the discussion physical factors were probably also important in the periodicity of phytoplankton and seasonal distribution of various species. The diatom flora in March, April, and May was marked by abundance of species reported in the literature to reach highest numbers in winter or spring. Species such as Melosira islandica or M. italica v. subarctica are among the very few which have been studied extensively (Lund, 1954; 1955) and are considered as ecological types growing best at low temperature and low light intensities (see also Hutchinson, 1967). Although apparently very little can be said with certainty about temperature or light preferences of the other spring dominants as Stephanodiscus alpinus, S. minutus, S. hantzschii or S. binderanus it is conceivable that low temperature and lower light intensities are optimal for their growth at times of adequate supply of nutrients. Similar seasonal patterns of these species (with the exception of S. alpinus, see page 141) have been observed in various parts of Lake Michigan (see Stoermer and Yang, 1970). It may be however, that only the abundant supply of nutrients in the spring is the most important factor which determines their growth.

The phytoplankton assemblages in the summer and fall contained as dominant algae Melosira granulata, M. granulata v. angustissima and C. meneghiniana which have been observed to grow best in warm waters and at high light intensities (see Rice, 1938; Hutchinson, 1967). Abundant growth of these species in the inshore lake during summer was apparently inhibited by depletion of nutrients and silica, although the physical conditions were potentially best for their development.

The influence of the river which contained high numbers of these three species was also an obvious factor determining the composition of the flora in these waters, particularly during the warmer months.

It appears that other physical factors such as turbulence also played a role in determining the distribution patterns of certain "heavy" species. Highest numbers of Melosira in all parts of water columns were found during circulation periods as in the spring and fall, but also in summer at times when they were most probably brought with inflowing river waters. In August during thermal stratification M. granulata, M. granulata v. angustissima and M. islandica were confined to the bottom waters of the hypolimnion. Stoermer and Kopczynska (1967), who studied phytoplankton in the southern basin of Lake Michigan, also observed that M. islandica--an offshore spring dominant--was present in abundance at all depths in April and May while in the summer and early fall its populations were restricted to deeper waters. Lund (1954, 1955) has documented that turbulence is necessary to keep M. italica and M. islandica in suspension. Observations on periodicity of various species of Melosira suggest that turbulence may play a significant role in determining the seasonal patterns of both cold and warm water forms of Melosira (see Hutchinson, 1967).

In general, the seasonal fluctuations of most of the dominant diatoms as noted in the present study were similar to those observed in various areas of Lake Michigan by Stoermer and Yang (1970) and in southern Lake Michigan by Stoermer and Kopczynska (1967). There were also noted certain differences. Some of them are explicable clearly by the fact that my spring samples were obtained also in March, while the earliest samples examined by Stoermer and Yang and those examined by us from the extreme southern portion of the Lake were collected in April. I noted that Stephanodiscus alpinus and S. transilvanicus were present in very high quantities in March; their rapidly declining numbers in April and May would suggest that both species reached peak abundance earlier in the winter. Stoermer and Yang (1970) observed that in several harbors and in northern Green Bay S. alpinus occurs

in equal abundance during spring and fall. They did not comment on the seasonal pattern of S. transilvanicus.

C. The Grand River Plume

1. Phytoplankton Fluctuations

In the middle of the plume, as in the river, highest abundance of total phytoplankton and total diatoms was noted during the warmer months (Figs. 13a to 13g). Peak numbers occurred in August (ave. total algae were 8700 units/ml; and ave. diatoms 5106 cells/ml) and September (ave. total algae 8235 units/ml; ave. diatoms 7362 cells/ml) when, according to calculations, the waters contained highest amounts of the river water. Lower populations, of similar sizes, were found during the colder months in March, April and November; the numbers of total algae ranged from 1435 to 3731 units/ml, and diatoms ranged 895 to 3263 cells/ml). The major algae of the summer and early fall were the same as in the river; Melosira granulata v. angustissima, M. granulata and Cyclotella meneghiniana v. plana (Table 1). In June, July, August, September and October they comprised together about 50 percent of the total flora. Also in April and May the river spring dominants (S. hantzschii, S. subtilis, S. tenuis, C. meneghiniana v. plana) were present in rather high numbers. Generally, however, in all periods of sampling the phytoplankton contained large quantities of principal lake species (that is species common at the Lake stations in the present study), such as Fragilaria crotonensis, F. capucina and Tabellaria fenestrata, which were abundant during most months or Synedra ulna v. chaseana, S. ulna v. danica, Nitzschia sp. #2 and Diatoma tenue v. elongatum which were very common in the spring. In fact the lake dominants were often present in numbers higher than at the Lake stations, evidently due to the greater concentrations of nutrients in the plume water (see Tables 1,7,8). The lake dominants were the major constituents of the plankton in March--the principal species, entirely different from those in the river, were: Stephanodiscus

alpinus, S. transilvanicus, Cyclotella stelligera, C. ocellata, Melosira islandica, Synedra ulna v. chaseana, Nitzschia sp. #2. As was observed in the river, the low temperature at this time must have inhibited the growth of the riverine species. Also in November when the colder river was sinking in entering the lake the riverine species were largely confined to the deeper waters, and F. crotonensis--the major lake diatom--comprised a significant proportion of the flora. The river dominants which were generally very numerous in the plankton of the middle plume, especially in surface waters, were often present there in a lower relative abundance than in the river. This was particularly evident in the case of C. meneghiniana v. plana and often but not always in the case of S. subiltis, S. hantzschii, S. minutus and Melosira granulata v. angustissima. In contrast, M. granulata comprised generally--except in the early spring--somewhat higher percentages of the phytoplankton in the middle plume than in the river.

Benthic algae--various species of Gomphonema, Diatoma, Nitzschia, Navicula, Synedra, etc., which were very common in the Grand River occurred in the middle plume in lower numbers and were mainly restricted to the deeper waters. It should be pointed out that Cyclotella meneghiniana is also considered as a primarily benthic species (Huber-Pestalozzi, 1942) although apparently its variety C. meneghiniana v. plana--the major riverine species--is very well adapted to planktonic existence (Stoermer and Yang, 1970).

In the edge of the plume, as in the lake, high phytoplankton populations were found in the early spring (in March total algae averaged 4396 units/ml; diatoms averaged 4040 cells/ml) and early summer (in June average numbers of total algae were 4300 units/ml and of diatoms 3600 cells/ml). Both peaks were characterized by different species and the June rise was more pronounced here than in the lake. Also as in the lake, lowest numbers were present in August (average phytoplankton 1071 units/ml, average diatoms 498 cells/ml) when the nutrients and silica poor waters had chemical characteristics close to those at the lake stations (see Figures 14a to 14g). The March peak was mainly attributed to the same diatoms

as those in the lake and the middle plume, and entirely different from those in the river. Stephanodiscus alpinus and S. transilvanicus occurred in numbers about twice as high as in the lake. The surface March counts--2116 cells/ml for S. alpinus and 903 cells/ml for S. transilvanicus, were also the highest for both species observed in the present study. In general the spring flora (March, April, May) contained, in majority, the principal lake species (Melosira islandica, M. italica subsp. subarctica, Cyclotella stelligera, C. ocellata, Stephanodiscus binderanus, Fragilaria crotonensis, Tabellaria fenestrata, Diatoma tenue v. elongatum, Synedra ulna v. chaseana) although the riverine dominants, especially Stephanodiscus hantzschii and S. minutus were also very numerous.

The major plankters during the summer and early fall were the riverine algae (Melosira granulata, M. granulata v. angustissima, Cyclotella meneghiniana v. plana), however, as in the middle of the plume, the flora also contained large populations of the lake species (Tabellaria fenestrata, Fragilaria crotonensis, F. capucina). As in the middle plume F. crotonensis dominated in November. Similarly, as at stations MP, the riverine species were generally found in highest numbers in surface waters, while the lake dominants were more abundant at greater depths. This was rather to be expected since in summer and early fall the warmer river water flowed on top of the colder lake water.

As in the middle plume the lake species were often more numerous than at the lake stations, although usually they were present in a lower relative abundance than in lake water. The riverine dominants which often declined drastically in numbers compared with the river, also decreased generally in relative abundance, however it was much less evident in the case of Melosira granulata.

In both the middle and the edge of the plume green algae were most abundant in the summer and early fall. Peak numbers were noted in August, especially in the middle plume where the average count

was 2907 units/ml. Flagellates were abundant throughout most of the year with highest quantities in May and November. Blue-greens, Chrysophyta and Pyrrophyta were much less common; highest numbers were usually found in the summer months (Table 3).

2. Correlations with Physical-Chemical Factors

Seasonal variations both in abundance and the species composition of phytoplankton in the plume area (stations MP and EP) reflected the periodicity observed in the river and in the lake. The influence of the river was most pronounced during the warmer months and especially evident in the middle plume, and the influence of the lake waters was more accented in the spring than in the summer and fall, and especially evident in the edge of the plume. In the middle plume as in the river highest numbers of total flora were found during the warm months in the summer and early fall. Nutrients and silica in the river seemed not to be limiting the growth, and the periodicity of phytoplankton resulted probably chiefly from the changes of temperature and light. In the middle plume depletion of phosphate and low concentrations of silica were noted on a few occasions (see Figures 13b,d,f). However, in spite of this the cell numbers were always high (total algae ranged 1440-14430 units/ml) and the large quantities of phytoplankton and their seasonal changes could mainly be attributed to the influence of the river flow bringing both phytoplankton and continuous supplies of nutrients. In the edge of the plume as in the lake seasonal changes of the flora appeared to be more related to the availability of nutrients and silica (see Figures 14a to 14g). Peak numbers at stations EP in March and June were found in nutrient rich waters, and smallest quantities occurred in August in waters containing lowest concentrations of nutrients. Both in the middle of the plume and edge of the plume increasing numbers of total phytoplankton were correlated with decreasing concentrations of phosphate and nitrate, suggesting that it is an area of a high competition for nutrients (see Section VI).

Generally, during all months the species compositions in the middle plume, the edge of the plume and in the inhsore lake were similar. The same diatoms, although present in each area in different proportions, were characteristic of the flora during the spring, summer and fall. In the summer and early fall the species composition in the plume area and lake reflected, to a high degree, the influence of the river phytoplankton. Principal algae from the river comprised a high or a very high portion of the flora at stations MP, EP and Lake. In the spring, especially in March, the major constituents of the phytoplankton in the plume area (MP, EP) and lake were generally different from those in the river; many species abundant at MP, EP and Lake were absent from the river, those present in the river occurred also in the plume and lake but most of the time in relatively small numbers.

D. Comparison with Other Studies in Lake Michigan

The chemical and biological results of the present study in the inshore lake waters and in the plume of the Grand River are comparable in many respects with earlier or concurrent studies in the same area or in other eutrophied protions of Lake Michigan. The chemical data obtained during the present work show rather pronounced seasonal changes in the concentrations of silica, nitrate nitrogen and orthophosphate (Tables 6e,g,h). Highest values were generally found in the early spring and late fall, considerable decline in late spring--early summer and lowest concentrations were observed in the summer and early fall. The depletion of nutrients as observed in surface waters in the lake during summer resulted most probably from utilization by phytoplankton in an earlier period of abundant growth. Such seasonal depletion of nutrients and particularly depletion of silica is commonly related to increasing eutrophication. As Lund (1965) has stated, "one of the first signs of increasing fertility is the appearance of a seasonal, usually vernal, decrease in silica content."

Summer decreases in concentration of surface silica in the eutrophied southern part of Lake Michigan were first documented by Ayers et al. (Fig. 46, 1958) and in southern and northern portions of the Lake by Risley and Fuller (1965). A general decrease of silica content in Lake Michigan during the past 40 years has been demonstrated by Powers and Ayers (1967) on the basis of data compiled by water filtration plants at Chicago, Milwaukee and Grand Rapids. The decline of surface silica has been attributed to enhanced utilization by diatoms; considerable increase of standing crop of phytoplankton near Chicago over the period of 1926 to 1958 was documented by Damann (1960).

As mentioned earlier in the discussion the low values of silica and nitrate nitrogen which were observed in the present study during the summer at the Lake stations and in some cases at stations MP and EP are comparable to those found in the same period in lake water near Grand Haven by Schelske, Stoermer and Feldt (1971) and by Schelske and Stoermer (1972). At the same time in the summer of 1969 Schelske and Callender (1970) examined samples from various parts of southern and northern Lake Michigan including the Green Bay and found that the surface waters contained similarly low concentrations of silica (0.15 ± 0.07 ppm in southern Lake Michigan), nitrate nitrogen (109 ± 15 ppb at all stations) and orthophosphate (concentrations were lower than 0.5 ppb in most samples, often phosphate was not detectable). On the basis of their own work (nutrient enrichment experiments with phytoplankton) and considering the available chemical data from Lake Michigan, Schelske and Stoermer have concluded (1972) that the decline of silica content in surface waters during the summer stagnation period can be attributed to the present inputs of phosphorus into the lake; phosphorus stimulates the growth of diatoms and their enhanced uptake of silica. Phosphorus pollution is also causing depletion of nitrate nitrogen (Schelske, in press, a,b).

The summer depletion of essential nutrients and most importantly of silica has significant effects on the quantitative and qualitative aspects of phytoplankton compositon. As observed by Schelske and

Stoermer (1971), diatoms, which require silica, were always the major algae of phytoplankton in Lake Michigan. They were still the predominant constituents of the flora in samples collected from southern Lake Michigan in 1962 and 1963 by Stoermer and Kopczynska. However, in August and September of 1969 Schelske et al. (1971) found that green and blue-green algae were present in numbers higher than diatoms at two stations located near Grand Haven. A concurrent study by Dr. J. C. Ayers showed that green and blue-green algae dominated in 22 samples collected over the entire lake (Schelske and Stoermer, 1971). I also observed that in August greens and blue-greens were dominant at both Lake stations and diatoms were practically absent from the upper parts of the water columns. Diatoms comprised also less than 50 percent at all sampling depths at station EP and in surface waters at station MP. At the surface at Lake station in July, Chrysophyta, greens and algae other than diatoms comprised about 45 percent of the phytoplankton. On the basis of these results obtained in Lake Michigan in the summer-early fall of 1969 Schelske and Stoermer (1971) predict that with a continuous depletion of silica perennial diatoms may be replaced in the future by other forms of algae as greens and blue-greens, since diatoms, dependent on the supply of silica, will not be able to compete with them for other essential nutrients. In fact, most recent data from southern Lake Michigan (Stoermer, 1971, unpublished) showed that blue-greens in high numbers dominated the flora during late summer and early fall months, particularly in the open waters of the lake.

As observed in the present study the diatom flora in the river plume and in inshore lake contained very interesting assemblages of species some of which are considered as typical of eutrophic or highly eutrophic environments, while others are characteristic of oligotrophic or highly oligotrophic waters. Diatom assemblages of such wide qualitative differences are common in more eutrophied inshore areas of Lake Michigan (see Stoermer, 1968; Stoermer and Yang, 1969, 1970). Stoermer and Yang (1970) have grouped dominant diatoms of Lake Michigan

into several types or categories according to their most common occurrence in waters of different degrees of trophic levels. Thus, for example, Cyclotella ocellata, C. operculata and C. Kützingiana are typical of "highly oligotrophic environments." These species are usually absent from the nearshore areas and are confined mostly to the northern part of the lake. Melosira italica subsp. subarctica, Synedra ulna v. chaseana, S. delicatissima v. angustissima, S. ostenfeldii and S. filiformis are "oligotrophic offshore dominants." Included in this group are also Rhizosolenia eriensis, C. michiganiana and S. transilvanicus which may prefer some higher degree of nutrient enrichment. Tabellaria fenestrata, T. flocculosa, Melosira islandica, Asterionella formosa and Fragilaria crotonensis are "eurytopic dominants"; they are most common in the lake and "apparently flourish under a wide range of environmental conditions." To the "eutrophic small lake forms" belong: Fragilaria capucina, F. capucina v. mesolepta, Melosira granulata and M. granulata v. angustissima species which are most common in harbors and in Green Bay. Characteristic of "disturbed habitats in large lakes" are: Stephanodiscus binderanus, S. alpinus, S. tenuis, S. hantzschii, S. subtilis, Cyclotella meneghiniana v. plana, C. pseudostelligera, Diatoma tenue v. elongatum, D. tenue v. pachycephala and Coscinodiscus subsalsa. These diatoms have been only recently introduced into Lake Michigan and are reported, often in high numbers, from polluted areas. Many of them have been observed to prefer brackish water habitats.

With the diatom species grouped in this manner--the summer and fall phytoplankton assemblages in the lake (Lake stations) and river plume may be characterized as dominated by eutrophic and eurytopic forms. The eutrophic species were predominant in the river plume while in the lake the eurytopic diatoms were generally somewhat more numerous. Cyclotella meneghiniana v. plana, species typical of "disturbed habitats" was conspicuous in all summer and fall samples. In the spring the flora contained high numbers of representatives of all five categories. In March most of the species were of the oligotrophic and eurytopic types, however, Stephanodiscus alpinus characteristic of disturbed habitats

was the most numerous alga, especially at the edge of the plume. The numbers of eutrophic species and those of polluted disturbed habitats increased in April and May; they were very abundant in surface waters of the middle plume in May. Oligotrophic and eurytopic species were also very common during these two months, especially at the lake stations. In contrast to the river plume and lake, the flora of the Grand River was at all seasons dominated by eutrophic or polluted-habitat species which are typical of highly eutrophic environments.

The spring flora in the inshore lake and the river plume contained all the species observed in the Grand Haven area by Stoermer at the end of April in 1967 (Stoermer, 1968). Stoermer studied phytoplankton at a time of the so-called thermal bar conditions (Noble and Anderson, 1968) when nutrients are expected to be "trapped" by quickly warming inshore waters which at first do not mix easily with much colder waters of the open lake. As observed in the present study nutrients were abundant in the spring both in the river plume and in the lake; however, since only a few temperature measurements were taken, it is difficult to judge whether the thermal bar was developed at the time of sampling. In March and April the water was much colder (Tables 5d,5c) than at the time of Stoermer's studies, when it was approximately 8°C in the plume and boundary waters, however, the surface temperature readings in May (about 10°C) were not much higher. Interestingly, the May phytoplankton assemblages resembled most closely those found by Stoermer. His samples were collected from the river channel, the river plume, inshore waters and offshore waters. It appears that the offshore stations where Stoermer sampled were located not much farther from the shore than my Lake stations in May or in April, and his inshore stations could well correspond to some of my EP or MP stations. (According to calculations no river water was present at station EP in April and only an average of 5 percent of the river water was found at station MP. The EP station in May contained an average of 2 percent of the river water.) The location of the river stations in both studies was very different--Stoermer's station was between the piers at the river outlet, mine was located about 2 km upstream.

In his study Stoermer observed several different types of species distribution. Such patterns similar for qualitatively comparable diatoms were in most cases expected because of the known distribution of these species in Lake Michigan. Thus, diatoms which are dominant in the open waters of the lake as Tabellaria fenestrata, Melosira islandica and Synedra ulna v. chaseana were found in highest relative abundance at the offshore stations and decreased in abundance behind the thermal bar toward the shore. Stephanodiscus hantzschii typical of eutrophic areas was also included in this pattern. Species as Stephanodiscus binderanus and S. tenuis which only recently appeared in the plankton of Lake Michigan were major dominants at the inshore stations, decreased in relative abundance toward the open lake and were rare in the river channel. Diatoms which are generally most common in eutrophied areas of Lake Michigan as Diatoma tenue v. elongatum, Fragilaria capucina were quite abundant in the river channel, less abundant in the inshore waters and reached highest relative abundance in the interface between the inshore waters and the main water mass of the lake. Asterionella formosa showed a similar pattern of distribution as the two above species. Still a different pattern was noted for Melosira granulata which is typical of polluted areas and rare in the open lake; it was most abundant in the river channel, decreased to low relative abundance in the inshore waters and still lower in the offshore waters.

Quite similar general patterns or trends in distribution of many of these species, with the exception perhaps of S. hantzschii, S. tenuis and D. tenue v. elongatum, were observed in the present study in the spring and during the remaining months. It should be pointed out however that the types of distribution of individual species were changing from one period of sampling to another, depending probably to a large extent on the degree of mixing of different water masses; only a close examination of the data (Table 2) revealed certain general trends or tendencies in the relative abundance of various species. Thus considering all of the periods of sampling I found the following types of distribution for some of the major diatoms:

Stephanodiscus transilvanicus and Melosira islandica occurred in highest relative abundance at the Lake stations, in somewhat lower abundance at the edge of the plume and lowest at the middle of the plume. The first species was entirely absent from the river, the second was found there only on two occasions (May and July).

Fragilaria crotonensis, F. capucina, Tabellaria fenestrata and Asterionella formosa were usually found in highest relative abundance in the lake, but also at times they were somewhat more abundant in the plume area. Generally they were least common in the river, although A. formosa was noted on one or two occasions in highest abundance at the river station.

Species abundant either in the lake or in the plume area were: Melosira italica v. subarctica, Diatoma tenue v. elongatum and Synedra ulna v. chaseana. The first species was absent from the river, the two latter ones occurred there only on rare occasions in low quantities.

Present in highest relative abundance in the plume area, especially at stations EP was Stephanodiscus binderanus,[1] it was less abundant in the lake and absent from the river. Stephanodiscus alpinus occurred in an equally high abundance at stations MP, EP and Lake. It was much less common or absent from the river.

The patterns of distribution of a few other species appeared to "run counter" to the patterns above.

Cyclotella meneghiniana v. plana was always found in highest numbers in the river--its relative abundance declined rather sharply toward the Lake stations.

Stephanodiscus subtilis, S. minutus and Melosira granulata v. angustissima occurred generally in highest relative abundance in the river, often however they were somewhat more abundant in the plume area. Lowest abundance was usually noted in the lake.

---

1. This species was absent from the flora in April, however it is easily confused with S. hantzschii and S. tenuis (see also Stoermer, 1968). In March all three species were absent from the Lake stations, but present in low numbers in the river plume.

Stephanodisens hantzschii, S. tenuis and Melosira granulata were found in highest relative abundance either in the river or the river plume (especially the last species comprised often a higher percentage of the flora in the plume) and in lowest abundance, usually, but not always, in the lake.

It appears from these results that practically all of these species are favored by or tolerant of the environmental conditions present in waters at stations MP and EP. All of these species, including the offshore dominants in Lake Michigan were present at least on a few occasions in high numbers and in a high relative abundance in the plume area that is in waters enriched by nutrients brought from the river. Stoermer and Yang (1969) have observed that some modern offshore dominants as Tabellaria fenestrata, Melosira islandica, Stephanodiscus transilvanicus appear to be "tolerant of changing conditions (of water quality) but are rapidly reduced in abundance with extensive chemically measurable change." Others such as Asterionella formosa, Fragilaria crotonensis, Stephanodiscus alpinus or Synedra ulna v. danica, "appear to be favored by slight increases in trophic level and flourish in moderately disturbed portions of the lake."

In the April study near Grand Haven Stoermer found that the average populations in inshore waters (1500 to 2000 cells/ml) were about six times higher than those in the river channel or those in offshore waters outside the thermal bar. In the present study I observed only in March and in August that the average total phytoplankton counts from the plume area (EP in March, MP in August) were higher than those in the river or in the lake. In April and during all other months highest average numbers were noted in the river, although at times, as in May, maximum populations in surface waters were found in the plume.

In general, the highest average counts at the Lake stations, in March (2960 units/ml) and in April (3330 units/ml) were comparable to the peak count reported in April from the Grand Haven area by Stoermer; they were higher than the average counts found by him, which in turn were of the same order as those reported in the early spring from inshore waters of southern Lake Michigan by Stoermer and Kopczynska (1967).

The highest populations found at the EP stations in March, April, June and July (range 1562 to 6180 units/ml) were comparable to those reported from the Grand Traverse Bay in May and June, of 1970 (Stoermer et al., 1972). In particular, the peak numbers (6180 units/ml in March, 4900 units/ml in June, 5887 units/ml in July) were of the order of those found in the west arm of the bay near the mouth of the Boardman River.

At stations MP highest counts were found in August (ave. 8700 units/ml) and in September (ave. 8235 units/ml); these numbers seem to be similar to the average counts recently found in the inshore waters of southern Lake Michigan in May (Stoermer, 1971, unpublished). The two maximum counts (14438 units/ml in August and 10010 units/ml in September) are similar to those reported in the summer of 1969 from the inshore waters of Lake Michigan in the vicinity of the River Manistee (Michigan Water Resources Commission, 1970). Apparently some of the highest algal populations in inshore waters of Lake Michigan are found in the plumes of inflowing rivers; a peak of 30000 cells/ml was reported in June 1971 from the plume of Burns Ditch at the southern shores of the Lake (Stoermer, 1971, unpublished data).

VI. STATISTICAL ANALYSES

Description of the Multiple Regression Method Used in the Analysis of Phytoplankton Species or Groups

The dominant phytoplankton groups, species and corresponding physical and chemical measurements were analyzed statistically by a multiple regression method. The analysis was done on the IBM 360 computer with the use of the BMD2R program "Stepwise Regression."

The main objective of the analysis was to learn if a given phytoplankton species or group (y, a dependent variable) depends on the various physical and chemical parameters ($x_1, x_2, x_3, \ldots,$ the independent variables), and if so, to get a measure of the relationship. The assumption was made that a linear model was appropriate for the range of the physical and chemical measures in the samples. The "Stepwise Regression" program gives a sequence of multiple regression equations, at each step adding a new independent variable to those included in the general equation. The variable added has the highest partial correlation with the dependent variable partialed on the variables already included in the equation. This way of computing facilitates the choice of the "best" equation, the basis for it being the highest increase in R^2 (square of multiple correlation coefficient) as well as the simultaneous statistical significance of the partial regression coefficients of the independent variables.

Tables 9a through 9e give multiple regression equations for each of the four station groups. They illustrate the relationship of the dependent variable y, (a given phytoplankton species or group) with the independent variables x, (physical and chemical measurements). The numbers corresponding with the independent variables are the partial regression coefficients, β, expressed in terms of units of y per unit of x, in this case as phytoplankton cells in 1 ml of water per unit of the chemical or physical parameter. Positive value of the regression coefficient indicates an increase of cells corresponding with an increase of the measured independent parameter, a minus sign shows

a negative correlation, an increase of y associated with a decrease of x, or vice versa, a decrease of y corresponding with an increase of x.

The constant, α, shows the interception point of the regression line with the y axis.

R, the multiple correlation coefficient, shows the joint relationship of the dependent variable with the independent variables in the multiple regression equation.

R^2, the coefficient of determination, indicates the percent of variance of the dependent variable which can be accounted for by the independent variables included in the equation. The higher its value, (going from zero toward one), the smaller is the variance of the deviations of y from the fitted regression line.

The F ratio tests the hypothesis that the regression coefficients simultaneously equal zero ($\beta = 0$).

The significance of each partial regression coefficient at 0.05 and 0.01 levels has also been determined.

If the multiple regression equation is expressed as:

$$\hat{y} = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots ,$$

where $\hat{y}$ is the estimated dependent variable (Phytoplankton species or group, number of cells)

α is a constant

β_i is a partial regression coefficient of x_i

x_1, x_2, x_3 are independent variables,

the general regression equation for Cyclotella meneghiniana v. plana at the river station (PP) (Table 9a) can be written as:

$$\hat{y} = -4792.6 + 1552.3\ (\text{Month}) - 247.4\ (\text{Chloride}) + 710.2\ (\text{Oxygen}) + 40.3\ (\text{Ortho-}PO_4) - 522.4\ (\text{Silica})$$

If we substitute in this equation the values of the independent variables for any month and any depth, for example the surface values for September, we obtain

$$\hat{y} = -4792.6 + 1552.3\ (9)^{1} - 247.4\ (32.5) + 710.2\ (7.0)$$

$$+ 40.3\ (75.0) - 522.4\ (0.69) = 8771.0$$

which is the predicted value (cells/ml) of Cyclotella meneghiniana v. plana at the surface in the river in September.

The coefficient of determination $R^2 = 0.80$ corresponding with this equation tells us that 80 percent of the variance for this species can be explained by the independent variables used in the equation.

The Use Made of the Statistical Analyses

Realizing that there are errors inherent in sampling, in chemical analyses and in phytoplankton counting, I have used the results of the Stepwise Regression analysis only as a tool or aid in sorting out the more important correlations between phytoplankton abundances and associated levels of chemical or physical factors. Tables 9a through 9e contain the partial correlation coefficients applicable in multiple regression equations relating phytoplankters to chemical and physical factors. From these tables there have been selected for certain diatoms and algal groups the partial correlation coefficients significant at the 1 and 5 percent levels; to these have been added the partial coefficients for certain chemical and physical factors commonly expected to be biologically active in phytoplankton growth, and hence of biological interest (although they may not be statistically significant). The significant coefficients and the biologically interesting partial coefficients that have more-than-small value are summarized in the table on page 160. In using Tables 9a through 9e and the summary table, no attention has been given to the numerical size of the partial coefficients, for the purpose has been not to predict the size of phytoplankton populations. Attention instead,

1. The numbers for months correspond with their calendar numerical order.

has been to the sign of the partial coefficients and to the degree of their statistical significance, for the purpose has been to determine the direct (plus sign) or indirect (minus sign) effect of each factor on local phytoplankton growth. Degree of, or absence of, statistical significance has been used in assessing the relative importance of the chemical or physical factor in phytoplankton growth. The statistical analyses used in this manner have served as: confirmation of points evident in graphic or tabular treatment of the data or as guides to missed evidence in the graphs or tables of data. The chemical, physical and phytoplankton data are presented in Tables 1 through 8, and in Figures 2 through 14.

Interpretations

Interpretations of the multiple regression analysis are given for:

Cyclotella meneghiniana v. plana
Melosira granulata v. angustissima
Melosira granulata
Bacillariophyta (total counts of all diatoms)
Total Algae (total counts of all algae)

Cyclotella meneghiniana v. plana, Melosira granulata v. angustissima and Melosira granulata were the three centric diatoms found most frequently and abundantly at the river station (PP) and the middle plume stations (MP) during the entire period of this study. Their numbers decreased sharply toward the lake, showing smaller counts at the edge of the plume stations (EP), and still smaller at the lake stations (LAKE), although there they often comprised a high percentage of the total Bacillariophyta, which in turn usually made up the majority of all phytoplankton.

The results of the multiple regression analysis for these three species as well as for the total phytoplankton and total Bacillariophyta are similar in that they often show best partial correlations with the

same independent variables associated with partial regression coefficients of the same sign. Thus the PP equations include most of the time negative correlations with chloride, silica and nitrate nitrogen, and positive correlations with orthophosphate. The Lake results show positive correlations with chloride and alkalinity and negative correlations with nitrate nitrogen and temperature. The results for both MP and EP differ from the PP and Lake stations and are somewhat alike in often having negative correlations with orthophosphate or nitrate nitrogen and positive ones with silica, oxygen, turbidity or light. The general similarities suggest that all the phytoplankton _in each station group_ respond in a similar way to the environmental conditions within the station group.

A. The River Station (PP)

Cyclotella meneghiniana v. _plana_ was by far the most abundant species found in the river with an average count of 3322 cells/ml, and a range of 281 to 8935 cells/ml. The highest numbers occurred in the summer and fall, with two peaks in July (ave. 6976 cells/ml) and October (ave. 8277 cells/ml). _Melosira granulata_ v. _angustissima_ was the second most numerous diatom with an average of 1206 cells/ml, a range of 9 to 3465 cells/ml and two peaks of similar sizes in June (ave. 2818 cells/ml) and October (ave. 2777 cells/ml). _Melosira granulata_ rated as the third dominant species with a peak in August (ave. 1363 cells/ml), an average of 665 cells/ml and a range of 8 to 2259 cells/ml. The average quantities of total phytoplankton and of total diatoms were 9073 units/ml and 7607 cells/ml, respectively. The numbers of total algae ranged between 1535 and 18940 units/ml, those of diatoms between 910 and 16940 cells/ml. Peaks of average numbers were observed in July (all algae 14468 units/ml, diatoms 12719 cells/ml) and in October (all algae 15958 units/ml, diatoms 14230 cells/ml).

Summary Table

Correlations with the Same Independent Variables for *Cyclotella meneghiniana* v. *plana*, *Melosira granulata* v. *angustissima*, *Melosira granulata*, Total Phytoplankton and Total Diatoms

PP	MP	EP	LAKE
- Chloride** (5)		+ Chloride** (1)	+ Chloride** (5)
- (NO_3-N)* (3)	- (NO_3-N)** (5)	- (NO_3-N) (1)	- (NO_3-N)* (5)
		+ (NO_3-N) (2)	
+ (Ortho-PO_4)** (4)	- (Ortho-PO_4)** (5)	- (Ortho-PO_4)* (3)	+ (Ortho-PO_4)* (1)
- Silica**(4)	+ Silica** (4)	+ Silica (3)	
		- Silica** (1)	
	+ O_2* (3)	+ O_2* (3)	
	+Light** (2)	+Light** (4)	
	+Turbidity** (5)	+Turbidity* (2)	
	+Sulfate* (2)	+Sulfate (4)	
	+Alkalinity (4)		+Alkalinity* (4)
	-Temperature (3)	-Temperature* (3)	-Temperature** (5)

Note: The numbers in parentheses indicate cases in which the independent variable entered the equations. The significance signs: ** at 1 percent level, * at 5 percent level are associated with the indicated cases.

1. Correlations with Chloride

The average chloride concentration in the water was 35.5 ppm and the range 22.5 to 50.0 ppm. In general the highest counts of the three species, the counts of total diatoms and of total phytoplankton, corresponded with decreased chloride (- chloride**)[1] within the given range. This may suggest an uptake[2] of chloride from the water. It would also indicate that *Cyclotella meneghiniana* v. *plana*, *Melosira granulata* v. *angustissima* and *Melosira granulata* which occurred in highest numbers in the river may have a preference for chloride contaminated water. *C. meneghiniana* is considered as a halophil species (Kolbe, 1927; Schroeder, 1939; Hustedt, 1938; Huber-Pestalozzi, 1942; Cholnoky, 1968). Rice (1938), who studied phytoplankton in the River Thames, observed highest development of this diatom at a locality receiving considerable amounts of salt water. According to Kolbe (1927), *M. granulata* and *M. granulata* v. *angustissima* are indifferent to a little salt.

2. Correlations with Orthophosphate

The levels of orthophosphate were high throughout the period of studies, the mean concentration was 68.9 ppb, the minimum individual value 38.6 ppb and the maximum 107 ppb. In general, there were increases of diatom counts with increasing orthophosphate concentrations, especially in the case of the total Bacillariophyta, *Melosira granulata* v. *angustissima* and *Melosira granulata*. The positive "+Ortho-PO_4**" relationship was evident at different depths of individual stations, e.g., July, August, September, October. It would seem that addition of orthophosphate to the water stimulates diatom growth[3] when all the other environmental conditions are suitable.

---

1. ** Indicates significance at 1 percent level.

2 Chlorine is an essential micronutrient for algae and is known to act as an enzyme activator in the oxygen evolution reaction in algal photosynthesis (see Eyster, 1964).

3. Algae are also known to be capable of a "luxury" uptake of phosphate. They store excess P in their cells and utilize it later on in periods when this element becomes depleted from the water (Rodhe, 1948; Mackereth, 1953; Hutchinson and Bowen, 1947; McCarter et al., 1952, Kuenzler and Ketchum, 1962).

3. Correlations with Silica

Silica concentration ranged between 0.62 and 8.25 ppm and the average was 4.43 ppm. The high counts of Cyclotella meneghiniana v. plana, Bacillariophyta and Melosira granulata v. angustissima were generally associated with decreasing silica values; e.g., July, August, September, and vice versa, lower counts corresponded with high silica concentrations in March and November. A "-silica**"[1] illustrates the negative correlation and suggests two things: an enhanced summer uptake of silica by diatoms stimulated evidently by the abundantly available orthophosphate; and the regeneration of silica into the water by diatom decomposition during the November-March period of smaller diatom growth.

4. Correlations with Nitrate

The nitrate nitrogen values found at station PP had a range of 20 to 1200 ppb and an average of 450 ppb. In general higher counts were associated with lower concentrations of nitrate nitrogen throughout the year as well as at different depths of individual stations (July, August, September, October). It was especially evident in case of Melosira granulata v. angustissima as well as Melosira granulata and the counts of total phytoplankton. A "-(NO_3-N)*"[2] correlation illustrates an uptake of nitrate nitrogen by the phytoplankton. It should be noted here that when in August nitrate nitrogen became very scarce (20 ppb at 6 meters and bottom) about 80 percent of the cells of Cyclotella meneghiniana v. plana were found to be empty frustules. At the same time the green algae reached numbers over 2000 cells/ml. It may be that the greens and other species of phytoplankton utilized the low available nitrate nitrogen, winning the competition for it from the diatom. However, the growth of Cyclotella meneghiniana v. plana could have been also inhibited by insufficient light (although probably

---

1. ** Indicates significance at 1 percent level. Used also on later pages.
2. * Indicates significance at 5 percent level. Used also on later pages.

sufficient for the greens) limited by very high turbidity, 37.1 ppm, contributed by extremely high amounts of detritus.

5. Temperature

The temperature range for abundant growth of *Cyclotella meneghiniana* v. *plana* (with counts above 1000 cells/ml) was 10° to 27°C. *Melosira granulata* v. *angustissima* and *Melosira granulata* had the same temperature range for counts above 75 cells/ml and above 100 cells/ml, respectively.

Conclusions for the River Station

1. The very high numbers of the phytoplankton at the river station may be attributed to:

   a. Plentiful orthophosphate in the water--even the minimum individual value found, 38.6 ppb, was in excess of the amounts which are likely to cause high blooms and nuisance algae conditions (about 30 ppb--Sawyer, 1947). Schelske and Stoermer (1972) observed during nutrient enrichment experiments with phytoplankton assemblages in Lake Michigan, that diatom growth increased with addition of 20 ppb PO_4-P. Addition of 7.5 μg P/l stimulated the growth of algae during experiments in Lake Superior (Schelske et al., 1972).

   b. Rather high average concentrations of silica and nitrate nitrogen and their enhanced uptake from the water by the well phosphate-nourished phytoplankton.

2. The phytoplankton species at the river station and first of all *Cyclotella meneghiniana* v. *plana*, *Melosira granulata* v. *angustissima* and *Melosira granulata* seem to require chloride at relatively high concentrations (the average chloride value was 35.5 ppm). It would also indicate their preference for waters with an appreciable chloride contamination.

B. The Middle Plume Stations (MP)

The numbers of *Cyclotella meneghiniana* v. *plana* ranged between 10 and 3439 cells/ml, the average count for the year was 843 cells/ml

and the maximum, an average of 2863 cells/ml, was found in September. The average count for <u>Melosira granulata</u> v. <u>angustissima</u> was 626 cells/ml, the range 0 to 3378 cells/ml, and the average peak numbers in September were 2664 cells/ml. <u>Melosira granulata</u> had an average of 419 cells/ml, a range of 5 to 2922 cells/ml, and its maximum of 1727 cells/ml (average count) occurred in August. In general the highest numbers of all three species were found during the summer and fall months. The counts of total algae ranged between 1439 and 14433 units/ml, those of total diatoms between 895 and 10093 cells/ml. The average quantities of total phytoplankton were 4761 units/ml and of diatoms 3710 cells/ml. Peak numbers occurred in August (ave. total algae were 8700 units/ml and ave. diatoms 5106 cells/ml) and September (ave. total algae 8235 units/ml; ave. diatoms 7362 cells/ml).

1. <u>Correlations with Silica</u>

The average silica concentration in the water was 1.54 ppm, the minimum 0.39 ppm and the maximum 6.40 ppm. A "+silica**" correlation illustrates that increasing numbers of total Bacillariophyta, <u>Melosira granulata</u> v. <u>angustissima</u>, <u>Melosira granulata</u> as well as of the total phytoplankton were generally associated with higher silica values.

It is characteristic that the positive correlations with silica were especially evident at those depths of the middle plume stations where there was a relatively high percentage of the river[1] water found: e.g., April surface; May surface; June surface and intermediate depths; August bottom and November bottom. The river flowing once at the top of the lake water, once at the intermediate depths and once at the bottom was bringing appreciable concentrations of silica and large amounts of phytoplankton. It would seem that at the MP stations the flow of the river is an important factor determining the amounts of these phytoplankters best thriving in highly eutrophied river water.

---

1. The percentages were calculated on the basis of values for chloride and sulfate.

2. Correlations with Turbidity

A "+ turbidity**" correlation associated with the three species, the total Bacillariophyta and the total phytoplankton illustrates positive correlations with turbidity. As the highest turbidity values were found at depths where there was a high percentage of the river water and high amounts of phytoplankton, which itself contributes to turbidity, it confirms again the role of the river flow in determining the amounts of algae in the MP group of stations.

3. Correlations with Orthophosphate

The orthophosphate concentrations ranged between 0 and 65.1 ppb, and the mean was 13.6 ppb, over five times less than at PP (68.9 ppb). The multiple regression analysis for *Cyclotella meneghiniana* v. *plana*, *Melosira granulata* v. *angustissima*, *Melosira granulata*, total Bacillariophyta and total phytoplankton show a "-(Ortho-PO_4)**" correlation, indicating that increasing cell counts corresponded in general with decreasing phosphate values, and smaller counts were associated with higher phosphate values during various months and at individual stations. The negative correlation of the phytoplankton with orthophosphate at MP, in contrast to the PP situation where the result was "+(PO_4)", could be explained by a high, increased demand for this nutrient in the middle of the plume, where its average concentrations were over five times smaller than in the river, but the average counts for the five phytoplankton groups considered were only about half as large (four times smaller in the case of *Cyclotella meneghiniana* v. *plana*). At several sampling depths in July and November orthophosphate was not detectable.

4. Correlations with Nitrate-Nitrogen

Nitrate nitrogen had an average concentration of 170 ppb (2.6 times less in comparison with the river concentration) and the values ranged between 10 and 480 ppb. A "-(NO_3-N)**" in the multiple regression analysis of the three species, the total Bacillariophyta, and total phytoplankton shows that in most cases higher numbers

of cells corresponded with decreasing nitrate nitrogen concentrations. It would indicate an uptake of this nutrient evident during different months and at different depths of individual stations. Lowest values of nitrate nitrogen were noted at several sampling depths in July and August during a period of development of green algae.

5. Temperature

The temperature range associated with high numbers (usually much above 100 cells/ml) of the three diatom species considered, in the summar and fall was: 9 to 24.2°C.

Conclusions for the Middle Plume Stations

1. The levels of phytoplankton in the middle of the plume, on the average twice smaller than in the river and four times smaller in the case of C. meneghiniana v. plana, can be explained by:

a. A fivefold decrease from the river concentrations in the amounts of available phosphate. Depletion of orthophosphate was noted several times, indicating a high increased demand for it by the phytoplankton.

b. About threefold decrease in the average concentration of silica. A drop in diatom numbers in July corresponded with average amounts of silica (0.38 and 0.46 ppm) lower than concentrations associated with small diatom growth elsewhere (0.50 ppm; Lund, 1950).

c. 2.6 fold decrease in the average concentrations of nitrate nitrogen.

The considerable decrease of the average concentrations of orthophosphate, silica and nitrate nitrogen compared with the river values, and the negative correlations of total phytoplankton, total diatoms and the three species with orthophosphate and nitrate suggest that the middle of the plume is an area of high competition for nutrients.

2. Since the higher counts of phytoplankton were generally found at depths where river water was detected, as well as relatively high values of silica and turbidity, it follows that the river flow was

an important factor determining the amounts of phytoplankton at the middle of the plume stations.

C. The Edge of the Plume Stations (EP)

Highest numbers of C. meneghiniana v. plana occurred in July (ave. 623 cells/ml) and October (ave. 716 cells/ml). The average count for the entire period of sampling was 236 cells/ml, and the range was 9 to 1584 cells/ml. M. granulata had an average of 122 cells/ml, a range of 1 to 501 cells/ml, and a maximum (ave. 394 cells/ml) was found in June. The average for M. granulata v. angustissima was 250 cells/ml, the range 2 to 1301 cells/ml, and the peak numbers (ave. 948 cells/ml) occurred in June. Smallest counts of all three species were found in March and April. The March counts for the total Bacillariophyta (ave. 4040 cells/ml) and the total phytoplankton (ave. 4396 units/ml) were high due to contributions by other spring species not discussed here. In general the average cell numbers of M. granulata v. angustissima, M. granulata, total diatoms and total phytoplankton were over four times smaller compared to the river counts and 14 times smaller in the case of C. meneghiniana v. plana.

1. Correlations with Silica

The individual silica values ranged between 0.36 and 7.00 ppm and the average concentration was 1.28 ppm. There is a "+Silica*" in the regression analysis of M. granulata v. angustissima, total Bacillariophyta and total phytoplankton (comprising mostly diatoms), but the relationship except for Bacillariophyta is not significant statistically. In case of the total Bacillariophyta the higher counts often corresponded with higher silica values (March, April, May, June, November) and small counts with decreased values (August, September). The positive relationship can be explained partly by the influence of the river flow bringing in silica and phytoplankton (e.g., June, surface, 20 percent of river water), and partly by the

contribution to the total diatom bulk of other species flourishing in the spring, when the silica values were high, particularly at the surface. The parallelism in the silica values--total Bacillariophyta counts was obvious also in August when lowest diatom counts (ave. 498 cells/ml) corresponded with lowest (0.49 ppm) silica concentrations.

A "-Silica**" in the multiple regression analysis of C. meneghiniana v. plana indicates negative correlations between this species cell counts and the amounts of silica in the water. An examination of the cell counts versus silica values shows that in fact the high counts (e.g., July, September, October) were associated with decreased silica suggesting its uptake, and small counts (in March, April and November) corresponded with high or very high silica concentrations indicating a release of silica into the water. It is interesting to note that the maximum of C. meneghiniana v. plana in July (surface) occurred when the silica concentration dropped to a low value of 0.40 ppm, and there was a complete depletion of phosphate. Evidently this species was brought from the river (7 percent content of river water was detected) and most probably had a sufficient phosphate supply stored in the cells and could utilize silica at very low concentrations. (See also discussion on pages 137-138.)

2. Correlations with Orthophosphate

The phosphate values had an average of 4.2 ppm, and the range was 0 to 35.6 ppb. A "-PO_4^*" correlation for M. granulata v. angustissima, Bacillariophyta and total phytoplankton shows a further increased demand (compared with MP), for orthophosphate by disproportionally large amounts of phytoplankton. The average orthophosphate concentration was 16.4 times smaller in comparison with the average value in the river, while the respective amounts of phytoplankton were four times smaller (about 14 times smaller in case of C. meneghiniana v. plana). There was a complete depletion of orthophosphate noted in the summer months--June (with the exception of surface), July and August. The lack of orthophosphate in August, coupled with very low concentrations of silica

evidently inhibited the growth of phytoplankton. (The still rather high counts in June and July can perhaps be explained by the fact that the phytoplankton were brought there from the river and had enough phosphate stored in their cells).

3. Correlations with Light

In most cases the highest counts of *C. meneghiniana* v. *plana*, total Bacillariophyta and *M. granulata* v. *angustissima* were found in well illuminated surface water. This is illustrated by a "+light**" in the regression analysis.

It should be noted here that all of the samples at the EP stations came from depths where there was some amount of light detected.

4. Correlations with Oxygen

A "$+O_2$*" associated with the analysis of total Bacillariophyta, *M. granulata* v. *angustissima* and the total phytoplankton illustrates evidently the enhanced photosynthetic activity of the phytoplankton as a result of which there is a release of oxygen into the water. The same situation was noted at the MP stations.

5. Correlations with Temperature

The temperature range at the sampling depths was 2 to 23.2°C. The highest individual counts for total Bacillariophyta and total phytoplankton in March (contributed by spring species) and June corresponded with either very low (2°C) or relatively low temperature, and the lowest counts in August corresponded with the maximum temperature. The negative correlation is noted in the regression analysis by a "-temperature*".

The range of temperature for *C. meneghiniana* v. *plana* counts of at least 50 cells/ml, was 4.5 to 23.2°C; the range for counts above 100 cells/ml was 9.5 to 23.2°C. *M. granulata* and *M. granulata* v. *angustissima* (counts at least 50 cells/ml) had a corresponding temperature range of 9.5 to 23.2°C.

6. Correlations with Turbidity

At the EP stations the average turbidity was 4.3 ppm and the range of individual values 1.9 to 9.8 ppm. A "+turbidity*", for the total Bacillariophyta and *M. granulata* v. *angustissima* shows that in general the higher counts were associated with higher turbidity values, e.g., May, June, July, September, October. It indicates that the phytoplankton itself contributed to the turbidity, and since the positive correlations were especially evident at depths where there was a relatively high percentage of the river water detected, it illustrates the fact that many of the phytoplankters were brought from the river and that river flow is an important factor in determining the amounts of phytoplankton at the edge of the plume stations.

7. Correlation of *C. meneghiniana* v. *plana* with Chloride

The highest counts of *C. meneghiniana* v. *plana* corresponded with increasing chloride values (especially June surface, July surface, September and October). This is indicated by a "+chloride**" in the regression analysis. It is characteristic that at the same depths there was a relatively high percentage of the river water found, undoubtedly an indication that this species had been brought by the river.

Chloride values ranged between 7.5 to 20 ppm, with a mean of 12.0 ppm, and the values found at the depths of highest *C. meneghiniana* v. *plana* counts were 12.5 to 15 ppm.

Conclusions for the Edge of the Plume Stations

1. The average phytoplankton counts at the edge of the plume were over four times smaller than in the river (14 times smaller in the case of *C. meneghiniana* v. *plana*). These can be explained by a further decrease in the amounts of available nutrients and silica:

   a. A 16.4 fold decrease in the average concentration of orthophosphate. As at the MP stations here also an increased demand for orthophosphate by disproportionally large amounts of phytoplankton was noted. There was a complete depletion

of orthophosphate in summer; both scarce silica and depletion of phosphates evidently inhibited the phytoplankton growth in August.

b. A 3.5 decrease in the average silica values. Low silica concentrations were noted in July (average 0.53 ppm) and August (average 0.49 ppm).

c. A threefold decrease in nitrate-nitrogen. Traces of NO_3-N were noted in July and August and coincided with the development of the greens and blue-greens.

2. As at the middle of the plume, also at the edge of the plume, the river flow was an important factor in determining the amounts of phytoplankton. It is evident from the positive correlations of phytoplankton with silica, chloride, sulfate, and turbidity at depths where river water was detected.

D. The Lake Stations, Inshore Area (LAKE)

Cyclotella meneghiniana v. *plana* had average counts of 104 cells/ml and a range of 0 to 1395 cells/ml. Highest numbers were found in September at station Lake 5; ave. 1240 cells/ml. In the spring and summer the numbers were small (generally below 40 cells/ml); the only higher count of 81 cells/ml was found in July at one meter below the surface. It should be noted here that the average quantities of *C. meneghiniana* v. *plana* at the lake stations were 32 times smaller in comparison with those observed at the river station.

The average yearly counts of *M. granulata* v. *angustissima* and *M. granulata* were 123 cells/ml and 79 cells/ml, respectively. They were over nine times smaller than the average numbers of the two species found in the river. The numbers of the first species ranged between 0 and 1261 cells/ml, and of the latter between 0 and 391 cells/ml. Highest quantities were found in the summer and fall particularly in deeper waters. The spring counts for both species were very small (0 to 30 cells/ml).

Total Bacillariophyta had an average count of 1268 cells/ml (six times less than at PP) but the range was extremely high; 1 to 3801 cells/ml. Highest numbers were found in the spring with a peak in April (ave. 2820 cells/ml) and also in September at station Lake 5 (ave. 3319 cells/ml). This station however was located close to the shore (0.8 km) and in the direction of the flowing river plume, so that the waters most probably contained also river water. Lowest numbers were observed in surface waters in July, August and September (in September at station Lake 1). The epilimnion at both stations in August, as well as the metalimnion at the August station Lake 1, were almost completely devoid of diatoms.

Total phytoplankton counts ranged between 421 and 4357 cells/ml, the average numbers were 1682 cells/ml (5.4 times less than in the river). Generally, the peaks and lows paralleled those of the diatoms.

The multiple regression analysis of the three species, total diatoms and total phytoplankton shows rather good positive correlations with chloride and alkalinity, and negative correlations with nitrate nitrogen (especially for *M. granulata* and *M. granulata* v. *angustissima*) and temperature (particularly for total diatoms and total phytoplankton).

1. Correlations with Chloride

The average chloride value was 10.8 ppm and the range 7.5 to 15.0 ppm. A "+chloride**" for *C. meneghiniana* v. *plana*, *M. granulata*, *M. granulata* v. *angustissima*, total diatoms and total algae indicates positive correlations of chloride with the inshore lake phytoplankton. The higher counts of phytoplankton at different stations and individual depths coincided generally with increased chloride values within the given range. It can only indicate two things--either a preference for waters with higher chloride contents, or that many of the phytoplankton species found at these lake stations (and most of all the three discussed centric diatoms which constituted at the lake stations an appreciable percentage of the total phytoplankton) were brought there from the river.

2. Correlations with Nitrate Nitrogen

The average nitrate nitrogen concentration was 149 ppb and the range 0 to 490 ppb. Higher counts, especially of M. granulata and M. granulata v. angustissima were usually found at depths with lower nitrate nitrogen values; e.g., June, August, September and October. A "-(NO_3-N**)" indicates an uptake of this nutrient from the water. Traces or zero concentrations of nitrate nitrogen were noted in summer, especially in August, and coincided with the development of green and blue-green algae.

3. Correlations with Orthophosphate

The average orthophosphate concentration was 3.3 ppb and the range 0 to 18.5 ppb. A "+PO_4*" was the only positive correlation for Melosira granulata. A depletion of orthophosphate was noted in May, June, July and August. It was coupled with very low concentrations of silica and nitrate nitrogen in July and August. The exhaustion of nutrients inhibited the phytoplankton growth to very low numbers, and the upper parts of the water columns in August were almost completely devoid of diatoms.

4. Correlations with Temperature

The temperature range at the sampling depths was 2.5 to 23.8°C. There were higher counts, particularly in case of the total Bacillariophyta, the total phytoplankton and M. granulata associated with decreasing temperature within the above range; e.g., March and April peak of diatoms and total phytoplankton contributed by spring species. The smallest numbers of diatoms and of total phytoplankton in July, August and September (at station Lake 1) corresponded with the highest temperatures.

The following are the temperature ranges for the discussed three diatoms when their counts were at least 50 cells/ml:

11.5 to 22.4°C C. meneghiniana v. plana, with the exception of April when the count at the surface was 61 cells/ml at 4°C.

11.2 to 19.2°C	M. granulata, except in August at the bottom, of station Lake 2, when the count was 84 cells/ml at 7.5°C.
11.2 to 19.7°C	M. granulata v. angustissima.

Conclusions for the Lake Stations

1. The relatively low average phytoplankton levels in the inshore lake area were undoubtedly associated with the low concentrations of nutrients and silica. The depletion of phosphate and the scarcity of silica and nitrate nitrogen during the summer and early fall evidently inhibited the phytoplankton growth and particularly the diatom growth.

The average orthophosphate concentration was 3.3 ppb, over 20 times less than at the river station. Silica with an average of 0.98 ppm decreased over four times, and nitrate nitrogen was three times less (ave. 149 ppb) in comparison with the river values.

2. The three centric diatoms: C. meneghiniana v. plana, M. granulata v. angustissima and M. granulata, whose average counts decreased very sharply in comparison with the river station, were generally associated with waters of chloride concentrations higher than the average value for the lake stations (10.8 ppm) and much higher than the average chloride concentrations for Lake Michigan (5 to 7 ppm; Powers and Ayers, 1967). This would clearly indicate their preference for chloride contaminated water, and suggest that they were brought to this area (at least the majority of the populations) from the river. Abundant growth of these species during summer was apparently prevented by inadequate amounts of nutrients and silica, and during spring, the low temperature must have inhibited their growth.

E. Additional Statistical Analyses of Several Dominant Diatoms and Major Algal Groups Other than Diatoms

A few diatom species which were abundant at certain times and algae other than diatoms were analyzed statistically in the same manner as the phytoplankters discussed above.

1. Correlations with Physical and Chemical Measurements of *Stephanodiscus transilvanicus*, *S. alpinus*, *Cyclotella ocellata*, *Melosira islandica* and *M. italica* subsp. *subarctica*

These diatoms were the spring dominants in the lake and in the river plume. At the LAKE all five species showed most of the time positive partial correlations with silica, phosphate and oxygen. *Stephanodiscus transilvanicus*, *S. alpinus* and *C. ocellata* showed also good negative correlations with carbon dioxide and turbidity. These results illustrate the fact that highest numbers of these species were found in the spring in well oxygenated and nutrient rich waters. It appears also that carbon dioxide could have been in special demand for some phytoplankters. Ayers et al. (1967) have discussed the possibility that free dissolved carbon dioxide may be present in a short supply during the winter-spring blooming of diatoms in Lake Michigan; with the lessened amounts of dissolved carbon dioxide diatoms turn to calcium bicarbonate for CO_2 with resultant precipitation of calcium carbonate. "Milky water"--containing crystals of calcium carbonate--observed by Ayers, was also noted during the present study in March, August and October.

At stations MP and EP the five species showed usually positive correlations with silica and negative correlations with phosphate; as in the case of the algae discussed previously (total phytoplankton, total diatoms, *C. meneghiniana* v. *plana*, *M. granulata* v. *angustissima*, *M. granulata*) this result again suggests an enhanced competition for phosphate in the river plume.

Stephanodiscus transilvanicus, *S. alpinus* and *C. ocellata* showed also negative correlations with temperature in the middle of the plume. The result for *S. alpinus* was not significant statistically.

Among these species only *S. alpinus*, *M. islandica* and *C. ocellata* were found in the river. The results showed positive correlations with phosphate, oxygen and temperature--*S. alpinus* and *M. islandica*--probably brought from the lake--were common in July in warm, phosphate-rich waters, and *C. ocellata* occurred in September.

2. Correlations for *Stephanodiscus binderanus*

This species was abundant in May and June in the river plume and in the lake. It was absent from the river. Negative correlations at the Lake with silica, phosphate and sulfate suggest uptake of nutrients and perhaps preference for lower sulfate content, or association with lake water rather (of lower sulfate content) than with the river water (of high sulfate content).

3. Correlations for *Stephanodiscus hantzschii*, *S. tenuis*, *S. subtilis* and *S. minutus*

These diatoms were the spring dominants in the river. Except for *S. minutus* which was absent in the fall, they were also common during other months, and *S. subtilis* and *S. tenuis* showed small peaks in the fall. All occurred in usually smaller numbers in the plume and still smaller in the lake. Highest populations were associated with nutrient rich waters.

Generally, in any one area (PP, MP, EP or LAKE) all four species often showed either positive or negative correlations with phosphate, silica and nitrate. Enhanced uptake of phosphate in the river during the spring growing season was illustrated by negative correlations of phosphate with *S. tenuis* and *S. subtilis*. In the river plume negative correlations with phosphate were noted for *S. subtilis* and *S. minutus*, and in the lake for *S. tenuis*, *S. hantzschii* and *S. minutus*. Positive correlations were found for *S. tenuis* and *S. hantzschii* in the plume area, and for *S. subtilis* in the lake.

The partial correlations of these species with silica were usually negative; significant statistically negative correlations were noted for *S. hantzschii* and *S. minutus* in the river and for *S. hantzschii* in the edge of the plume.

Significant negative correlations with nitrate nitrogen were those of *S. subtilis* in the river and of *S. tenuis* at EP. Positive correlations were noted for *S. subtilis* at EP and for *S. hantzschii* at Lake. These somewhat confusing results or lack of pattern in the correlations may

have very well reflected the usual confusion associated with identification of these similar morphologically froms of Stephanodiscus. It is important, however, that the correlations did occur, suggesting that abundance of these species was determined by the abundance of nutrients in the spring.

The results at stations PP and EP showed usually negative correlations with temperature, and in the plume area (MP and EP) and Lake positive correlations with sulfate and chloride--an indication that largest populations of these species were found during colder months, and that they were mainly associated with the river water of high sulfate and chloride content.

As in the case of the lake spring dominants--S. hantzschii showed negative correlation with carbon dioxide at the edge of the plume.

4. Correlations for Fragilaria crotonensis

Fragilaria crotonensis was a perennial dominant in the lake with high numbers in the fall and summer. It was also abundant in the river plume (particularly in the fall and summer) and in the river (especially in the summer).

The results for stations MP, EP and Lake often included positive correlations with light, oxygen, pH and phosphate, and negative correlations with nitrate and with temperature. However, only the correlations with temperature at MP and EP, and with light at EP were significant statistically.

The results for station PP showed good positive correlations with phosphate and temperature and negative correlations with alkalinity.

5. Correlations for Coscinodiscus subsalsa

This species which is characteristic of polluted areas, was common in the river in the summer and fall. Smaller numbers were present in the plume, and still smaller in the lake.

There were negative correlations with oxygen at all stations, negative correlations with nitrate and temperature, and positive ones

with alkalinity, chloride and sulfate at stations PP, MP and LAKE, and negative correlations with silica at PP and MP. Although many of these results were not significant statistically, nevertheless they suggest uptake of silica and nitrate in colder (deeper?), eutrophic waters (positive correlations with sulfate, chloride and alkalinity) of lowered oxygen content.

6. Correlations for Green Algae

In all areas of the studies green algae were found in highest numbers during the summer. Within each station group the greens showed negative partial correlations with nitrate nitrogen, and positive ones with pH and oxygen. Correlations with light were positive at stations MP, EP and Lake, and negative at PP.

There were also noted negative correlations with phosphate at MP, with silica at Lake, and positive correlation with silica at PP. Both results for silica however, were not significant statistically.

Perhaps the most interesting results were the negative correlations with nitrate; greens were found in highest numbers during summer in nitrate poor waters.

7. Correlations for Blue-Green Algae

In general the results for each station group showed positive correlations with temperature (blue-greens occurred in highest abundance in the summer) and negative correlations with light.

At station PP significant statistically positive correlations were with phosphate and nitrate, and negative correlations with sulfate.

8. Correlations for Chrysophyta, Pyrrophyta and Flagellates

The first two groups of algae were generally found in highest numbers in the summer, and flagellates were most abundant in the spring and late fall.

Certain general similarities were noted in the results for these phytoplankters. Within any one of the station groups, Chrysophyta,

Pyrrophyta and flagellates often showed positive correlations with phosphate, and at stations MP, EP and Lake negative correlations with silica. Correlations with nitrate nitrogen were either positive or negative and significant only at EP; for Pyrrophyta (positive result) and for Chrysophyta (negative result).

These results may indicate that higher numbers of these algae were associated with waters of lowered silica content (Chrysophyta require silica for formations of spores) and suggest also growth stimulation by phosphate. However, the positive correlations of Chrysophyta with phosphate (significant at PP and Lake) are somewhat surprising since Dinobryon divergens, which was the major representative of this group, reportedly prefers phosphorus-poor waters (see Hutchinson, 1967).

Conclusions

1. Spring-flourishing diatoms in the lake, in the river and in the river plume were found in nutrient-rich waters. This was reflected by correlations of these species with phosphate, silica and nitrate. Occasionally noted negative partial correlations of some of the spring dominants (Stephanodiscus transilvanicus, S. subtilis, S. tenuis, S. hantzschii, S. minutus, Cyclotella ocellata) with temperature, suggest that colder water--together with abundant nutrients--may be favorable for their growth. Negative correlations of most spring diatoms (Stephanodiscus transilvanicus, S. alpinus, S. subtilis, S. minutus, Cyclotella ocellata, Melosira islandica and M. italica subsp. subarctica) with phosphate in the river plume suggest enhanced uptake and competition for this nutrient--a result obtained also in the analyses of total algae, total diatoms, Cyclotella meneghiniana v. plana, Melosira granulata v. angustissima and M. granulata.

2. It appears that Coscinodiscus subsalsa may flourish better in waters of low oxygen content.

3. Summer depletion of nitrate observed in all areas of the studies may perhaps be attributed to a high degree to the uptake by green algae.

4. It appears that Pyrrophyta and flagellates may reach highest numbers in waters of low silica content. It is likely that phosphate stimulates their growth.

F. Summary

1. Three centric diatoms, Cyclotella meneghiniana v. plana, Melosira granulata v. angustissima, and Melosira granulata occurred in abundance in the Grand River, particularly in the fall of 1968 and in the summer of 1969. Their numbers (cells/ml) diminished sharply toward the inshore lake area. A more than ninefold decrease in the average numbers of M. granulata v. angustissima and M. granulata was noted at the lake stations in comparison with the river station. The average numbers of C. meneghiniana v. plana decreased 32 times.

2. The temperature range favoring their growth in the summer and fall seems to be 9 to 27°C. All three species were also present in March or April at such low temperatures as 2°C and 4°C, however, their counts were low, and especially low for M. granulata v. angustissima and M. granulata (MP, March, EP-March, April). C. meneghiniana v. plana which was present at low spring temperature in the river and the plume area in quantities substantially larger than the two other species (often about 50 cells/ml) was absent from the lake station in March at 2 to 3°C. All three species are usually reported in literature to reach highest numbers during the warmer months of the year (see Rice, 1938; Budde, 1928; Hutchinson, 1967; Whitford and Schumacher, 1963; Schroeder, 1939).

3. It seems that high light favors the growth of these three species. In this study it was especially noted in the river plume area (MP, EP). Rice (1938) observed that C. meneghiniana prefers well-lighted water.

4. C. meneghiniana v. plana, M. granulata v. angustissima and M. granulata seem to prefer water with rather high chloride concentrations; the average chloride value in the river was 35.5 ppm. Even the populations of these species present at the lake stations were found in waters with

chloride values much higher than the average value for Lake Michigan (5 to 7 ppm--Powers and Ayers, 1967). Stoermer and Yang (1970) mentioned C. meneghiniana v. plana among diatoms which have been observed to occur in chloride contaminated waters.

5. Highest numbers of the three species were found in the eutrophic river water characterized by the following average chemical values obtained during the present study: chloride 35.5 ppm, sulfate 67.7 ppm, total alkalinity as $CaCO_3$ 203 ppm, pH 8.7, orthophosphate 68.9 ppb, silica 4.43 ppm, nitrate-nitrogen 450 ppb. It appears that their development was strictly related to the high amounts of particularly phosphate, silica and nitrate nitrogen. The increases in numbers of these species were noted to be proportional to the level of phosphate in the water. The amounts of phosphate present seemed to stimulate their growth and an enhanced uptake of silica and nitrate nitrogen. The average orthophosphate value was more than twice the amount associated with nuisance algae conditions elsewhere (ca. 30 ppb, Sawyer, 1947).

6. The drastic decrease in the quantities of these diatoms from the river to the inshore lake waters was evidently related to the dilution of the river in the lake; the flow of the river was an important factor determining the quantities of these species in waters at stations MP and EP. This was illustrated by the positive correlations of algae with turbidity, silica, sulfate, alkalinity and chloride evident at depths where river water was detected.

7. As observed in the present study warm water, high concentrations of nutrients and appreciable amounts of chloride seem to be necessary for abundant growth of C. meneghiniana v. plana, M. granulata and M. granulata v. angustissima. High development of these species in the inshore lake waters in the spring must have been prevented by low temperature, and during summer depletion of nutrients apparently inhibited their growth. Particularly C. meneghiniana v. plana appeared to be the least successful of the three species in the inshore waters of the lake. It appears unlikely that these three species dependent on warm water, abundant nutrients and rather high chloride content will ever reach high abundance in the open waters of Lake Michigan. Stoermer and Yang (1970) observed

that M. granulata and M. granulata v. angustissima "appear to be temperature limited and, unless thermal pollution proceeds to very high levels, it is doubtful that they can occupy the offshore waters of Lake Michigan successfully."

8. The average numbers of total algae and of total diatoms were higher in the river than in the plume area and much higher than in the lake. The differences in levels of algae in the four areas of study were evidently associated with the decline from the river to the lake of the amounts of phosphate, silica and nitrate nitrogen.

9. The river plume appears to be an area of high competition for nutrients. Especially noteworthy was the drastic disappearance of phosphate in the river plume, (stations MP, EP), almost directly proportional to the decrease of C. meneghiniana v. plana. Apparently the dominant species in the river store excess phosphate in their cells and utilize it actively later on in the plume region where the demand and competition for this nutrient seem to be very much increased. Traces or zero phosphate concentrations were noted repeatedly in this area, however, the populations of the three riverine species observed at the same depths occurred in rather high numbers, while many of the remaining phytoplankton species were present in small numbers (especially in July and August). Generally the depletion of phosphate noted at various times in waters of the plume area did not actually limit the populations of Bacillariophyta as a whole; the individual total diatom counts were at least 1300 cells/ml. In only one case in August, EP, where no river water was detected, the diatom numbers were limited to 498 cells/ml, and it seems that the depletion of phosphate was the responsible limiting factor. (The average silica value, however, was only 0.49 ppm, and there were only traces of nitrate nitrogen).

Silica and nitrate at the MP and EP stations, much decreased in comparison with the river values, seemed often to be present in a sufficient supply to support high numbers of diatoms but sometimes their concentrations fell to very small values; (e.g., July MP, July and August EP).

10. In the inshore lake area (Lake) scarce silica, nitrate and depletion of phosphate apparently inhibited the diatom growth in surface waters in July, August and September. However it may well be that phosphate was the major limiting nutrient (see discussion in Section V, subsection Lake).

11. High numbers of spring flourishing diatoms in the river, the river plume and in the inshore lake were apparently determined mainly the the abundance of nutrients in the spring. Negative correlations of Stephanodiscus transilvanicus, S. subtilis, S. tenuis, S. hantzschii, S. minutus and Cyclotella ocellata with temperature suggest that good development of these species might be expected in colder waters.

12. Warm water is apparently favorable for the growth of blue-green algae.

13. Perhaps the main conclusion to be drawn from both the statistical results and the examination of chemical and physical data versus algal counts is that phosphorus was the most likely nutrient controlling the abundances of algae in the four areas of study. Highest numbers of phytoplankton were found in the river waters rich in phosphates. The increases of algae in the river seemed to be proportional to the levels of phosphate in the water; this was illustrated by the positive correlations of algae with phosphate. The river plume (stations MP and EP) appears to be an area of a high competition for decreasing nutrients and particularly for drastically decreasing phosphate; this was illustrated by the negative correlations of algae with phosphate. Lowest numbers of algae and lowest concentrations of nutrients were found in the lake; the growth of diatoms in the summer and early fall was evidently inhibited by depletion of phosphate, silica and nitrate, and it is highly possible that phosphate was the major limiting factor.

VII. GENERAL CONCLUSIONS

Analysis of the phytoplankton and associated environmental factors in the lower Grand River, in the river discharge into Lake Michigan and in the adjacent inshore waters of the lake, showed pronounced differences between the areas of studies in the physicochemical conditions and in the numerical abundance and quality of the phytoplankton.

The Grand River, where highest numbers of algae were found (the average yearly abundances were more than fivefold greater than in the lake), had highest concentrations of various chemical constituents including phytoplankton nutrients, and lowest Secchi disc transparencies; it appears to be highly eutrophied and more productive than the adjacent inshore lake waters. The river plume area, where intermediate--between the river and the lake--values of productivity-related parameters were observed, seems to be also more productive than the inshore lake. It should be pointed out however, that in late winter--early spring, one might expect largest quantities of phytoplankton in the plume--inshore lake region, since abundant growth of major algae in the river (Cyclotella meneghiniana v. plana, Melosira granulata v. angustissima and M. granulata) during this period, particularly when the river is covered with ice, appears to be inhibited by insufficient light and low temperature.

Differences in the levels of total phytoplankton between the river, the middle of the river plume, the edge of the plume and the lake appeared to be associated with the decline from the river toward the lake in the amounts of phosphates, nitrates and silica.

Diatoms were the predominant phytoplankters in all areas except in the lake during August, when greens and other algae were more abundant. The phytoplankton of the Grand River was at all times dominated by diatoms typical of highly eutrophic waters, while the river plume and the lake floras contained diatom assemblages with high numbers not only of eutrophic, but also of oligotrophic and eurytopic types.

Qualitative differences of the flora between the areas of studies, particularly between the river on one hand, and the river plume and the

lake on the other, are probably explicable mainly by the differences in the level of essential nutrients. However, the absence from the river (or presence in small quantities) of several eutrophic species, which were abundant in the plume and in the lake, suggests that differences in concentrations of various other chemical constituents such as high chloride and sulfate in the river were most likely also significant in influencing the distribution of these species.

It appears that seasonal variations in abundance of total phytoplankton in the Grand River resulted chiefly from the changes of temperature and light. Nutrients and silica in spite of variations were present in rather large supply and it is unlikely that they were limiting to algal growth. However, the fact that phosphates were always abundant and the observed minimum values of nitrate (20 ppb) and silica (0.62 ppm) suggest that both nitrate and silica may become diminished in these waters during phytoplankton maxima in the summer or fall.

In the inshore lake seasonal changes in abundance of phytoplankton, as well as the seasonal succession of dominant species, appeared to be associated mainly with the availability of phosphate, nitrate and silica. Inhibition of diatom growth was evident in surface waters during summer and early fall. Low numbers of diatoms, especially in August coincided with a general depletion of nutrients. Any one of the nutrients measured might have been limiting to diatom growth; however, it is very likely that phosphorus was the major limiting factor.

Seasonal changes both in abundance and the species composition of phytoplankton in the river plume area appeared to reflect both the periodicities observed in the river and in the lake. The influence of the river phytoplankton was most pronounced during the warmer months and especially evident in the middle of the plume, where highest numbers of the total flora were found during the summer and early fall. The influence of the lake waters was more accented in the spring than in other seasons and was especially evident in the edge of the plume; as in the lake, the plume edge peak numbers were found in the spring and lowest quantities occurred in August when the nutrient poor waters had chemical characteristics close to those at the lake stations.

The fact that highest numbers of phytoplankton taxa were almost invariably found in the middle of the plume, and that practically all of the major diatoms, including the oligotrophic offshore dominants in Lake Michigan occurred--at least on several occasions--in high numbers and in high relative abundance in the plume area, suggests that the river plume is a region of favorable environmental conditions for many phytoplankters. The river plume appears to be also an area of high competition for nutrients, particularly for drastically disappearing phosphate.

The flow of the river is an important factor in determining the amounts and quality of phytoplankton in the middle of the plume and the edge of the plume, especially during the warmer months. It is also an obvious factor in influencing the species composition in the inshore lake waters. Consideration of all the chemical and phytoplankton data leads one to the conclusion, that although the Grand River is undoubtedly an important source of many phytoplankters for the inshore lake, its main role is in modifying the chemical conditions of the inshore lake waters.

Abundant growth of diatoms *Cyclotella meneghiniana* v. *plana*, *Melosira granulata* v. *angustissima* and *M. granulata* which were the principal algae in the Grand River, and which comprised also a significant portion of the flora in the river plume and in the lake, appears to depend on warm water, good light, abundant nutrients and appreciable amounts of chloride. High development of these species in all areas during spring was evidently inhibited by low temperature, and during summer in the lake depletion of nutrients must have inhibited their growth. These diatoms may never be abundant in the open waters of Lake Michigan.

It is likely that abundant growth of spring-flourishing diatoms--*Stephanodiscus transilvanicus*, *S. alpinus*, *S. hantzschii*, *S. binderanus*, *S. tenuis*, *S. subtilis*, *S. minutus*, *Cyclotella ocellata*, *Melosira islandica* and *M. italica* subsp. *subarctica*--is determined mainly by the abundance of nutrients in the spring. Cold water--together with abundant nutrients--might be favorable for the development of *S. transilvanicus*, *S. subtilis*, *S. tenuis*, *S. hantzschii*, *S. minutus* and *C. ocellata*.

Coscinodiscus subsalsa, a diatom typical of polluted waters, may be favored by low oxygen content.

Good growth of blue-green algae might be expected in warm water.

Pyrrophyta and flagellates may flourish better in waters of low silica content. It is likely that phosphate stimulates their growth.

Examination of physical, chemical and phytoplankton data compared with the results of multiple regression analyses leads to the conclusion that phosphorus was the nutrient most likely to control the numerical abundances of algae in all the areas of study. Phosphate was the most likely nutrient stimulating the abundant growth of phytoplankton in the river and an enhanced uptake of silica and nitrate. Negative correlations of total algae, total diatoms and dominant species with phosphate in the river plume, suggested high competition for this nutrient. Phosphate was also the likely major nutrient to be limiting diatom growth during the summer and early fall in the inshore lake.

VIII. REFERENCES

ALLEN, W. E. 1920. A quantitative and statistical study of the plankton of the San Joaquin River and its tributaries in and near Stockton, California, in 1913. Univ. California, Pub. Zool. 22, 292 p.

AYERS, J. C., D. C. CHANDLER, G. H. LAUFF, C. F. POWERS and E. B. HENSON. 1958. Currents and water masses of Lake Michigan. Univ. Michigan, Great Lakes Res. Div., Pub. No. 3, 169 p.

_______ and R. ROSSMANN. 1967. The Grand River and its plume in Lake Michigan. Univ. Michigan, Great Lakes Res. Div., Spec. Rep. No. 30: 366-371.

_______ and E. F. STOERMER and P. McWILLIAM. 1967. Recently noted changes in the biology-chemistry of Lake Michigan. Univ. Michigan, Great Lakes Res. Div., Spec. Rep. No. 30: 95-111.

_______. 1970. Lake Michigan environmental survey. Univ. Michigan, Great Lakes Res. Div., Spec. Rep. No. 49.

BLUM, J. L. 1956. The ecology of river algae. Bot. Rev. 22: 291-341.

______. 1957. An ecological study of the algae of the Saline River, Michigan. Hydrobiologia 9(4): 361-407.

BUDDE, H. 1928. Die Algenflora des sauerländischen Gebirgsbaches. Arch. Hydrobiol. 19: 433-520.

CHOLNOKY, B. J. 1968. Die Ökologie der diatomeen in binnengewässern. Lehre, J. Cramer, 699 p.

CLAUS, G. 1961. Monthly ecological studies on the flora of the Danube at Vienna in 1957-58. Verh. Internat. Verein. Limnol. 14: 459-465.

COFFING, C. 1937. A quantitative study of the phytoplankton of the White River Canal, Indianapolis, Indiana. Butler Univ., Botan. Stud. 4: 13-31.

CUSHING, C. E. 1964. Plankton and water chemistry in the Montreal River lake-stream system, Saskatchewan. Ecology 45: 306-313.

DAMANN, K. E. 1960. Plankton studies of Lake Michigan. II. Thirty-three years of continuous plankton and coliform bacterial data collected from Lake Michigan at Chicago, Illinois. Trans. Amer. Microscop. Soc. 79: 397-404.

DAVIS, C. C. 1964. Evidence for the eutrophication of Lake Erie from phytoplankton records. Limnol. Oceanogr. 9: 275-283.

______. 1965. The standing stock of phytoplankton in Lake Erie at Cleveland, Ohio, 1964. Info. Bull. Planktol. Japan 12: 51-53.

ENACEANU, V. 1964. Das Donauplankton auf rumänischen Gebiet. Arch. Hydrobiol. Suppl. 27: 442-456.

EYSTER, C. 1964. Micronutrient requirements for green plants, especially algae, p. 86-119. In D. F. Jackson [ed.], Algae and Man, Plenum Press, New York.

GREENBERG, A. E. 1964. Plankton of the Sacramento River. Ecology 45: 40-49.

HOHN, M. H. 1969. Qualitative and quantitative analysis of plankton diatoms, Bass Island area, Lake Erie. Bull Ohio Biol. Surv. 3: 1-211.

HOLLAND, R. E. 1968. Correlation of Melosira species with trophic conditions in Lake Michigan. Limnol. Oceanogr. 13: 555-557.

______. 1969. Seasonal fluctuations of Lake Michigan diatoms. Limnol. Oceanogr. 14: 423-436.

HUBER-PESTALOZZI, G. 1942. Das Phytoplankton des Süsswassers, p. 367-549. In A. Thienemann [ed.], Die Binnengewässer, Band 16, Teil 2, Hälfte 2. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart.

HUGHES, J. C. and J. W. G. LUND. 1962. The rate of growth of Asterionella formosa Hass. in relation to its ecology. Arch. Microbiol. 42: 117-129.

HUSTEDT, F. 1938. Systematische und ökologische Untersuchungen über die Diatomeen-flora von Java, Bali und Sumatra. Arch. Hydrobiol. Suppl. 15: 131-506.

______. 1939. Systematische und ökologische Untersuchungen über die Diatomeen-flora von Java, Bali und Sumatra nach dem Material der Deutschen Limnologischen Sunda-Expedition. III. Die ökologischen Faktoren und ihr Einfluss auf die Diatomeen-flora. Arch. Hydrobiol. Suppl. 16: 274-394.

HUTCHINSON, G. E. and V. T. BOWEN. 1947. A direct demonstration of the phosphorus cycle in a small lake. Proc. Nat. Acad. Sci. 33.

________. 1967. A treatise on limnology, Vol. II. An introduction to lake biology and the limnoplankton. New York, John Wiley and Sons. 1115 p.

HYNES, H. B. N. 1970. The ecology of running waters. Univ. Toronto Press. 555 p.

JØRGENSEN, E. G. 1964. Adaptation to different light intensities in the diatom Cyclotella Meneghiniana Kütz. Physiologia Planatarum 17: 136-145.

________. 1957. Diatom periodicity and silicon assimilation. Dansk. Bot. Arkiv. 18, 54 p.

KILHAM, P. 1971. A hypothesis concerning silica and the freshwater planktonic diatoms. Limnol. Oceanogr. 16: 10-18.

KOFOID, C. A. 1903. The plankton of the Illinois River, 1894-1899, with introductory notes upon the hydrography of the Illinois River and its basin. Part I. Quantitative investigations and general results. Bull. Illinois State Lab. Nat. Hist. 6: 95-629.

______. 1908. The plankton of the Illinois River, 1894-1899. Part II. Constituent organisms and their seasonal distribution. Bull. Illinois State Lab. Nat. Hist. 8: 1-361.

KOLBE, R. W. 1927. Zur Ökologie, Morphologie und Systematic der Brackwasser-Diatomeen. Pflanzenforschung 7, 1-146.

KUENZLER, E. J. and B. H. KETCHUM. 1962. Rate of phosphorus uptake by Phaeodactylum tricornutum. Biol. Bull. 123: 134-145.

LACK, T. J. 1971. Quantitative studies on the phytoplankton of the Rivers Thames and Kennet at Reading. Freshwat. Biol. 1: 213-224.

LEMMERMANN, E. 1907. Das Plankton der Weser bei Bremen. Arch. Hydrobiol. Planktonk. 2: 393-448.

LEWIN, J. C. 1961. Silicon as an essential element for diatom cultures. Rec. Advan. Bot. 1: 253.

_____. 1962. Silicification, p. 445-455. In R. A. Lewin [ed.], Physiology and Biochemistry of Algae. Academic Press. New York and London.

_______ and R. L. GUILLARD. 1963. Diatoms. Ann. Rev. Microbiol. 17: 393.

LUND, J. W. G. 1950. Studies on Asterionella formosa Hass. II. Nutrient depletion and the spring maximum. Parts I - II. J. Ecology 38: 1-35.

____. 1954. The seasonal cycle of the plankton diatom Melosira italica (Ehr.) Kütz. subarctica O. Müll. J. Ecology 42: 151-179.

____. 1955. Further observations on the seasonal cycle of Melosira italica (Ehr.) Kütz. subsp. subarctica O. Müll. J. Ecology 43: 90-102.

____. 1964. Primary production and periodicity of phytoplankton. Verh. Internat. Verein. Limnol. 15: 37-56.

____. 1965. The ecology of the freshwater phytoplankton. Biol. Rev. (Cambridge) 40: 231-293.

____. 1969. Phytoplankton, p. 306-330. In Eutrophication: causes, consequences, correctives. Nat. Acad. Sci., Washington, D. C.

MACKERETH, F. J. H. 1953. Phosphorus utilization by Asterionella formosa Hass. J. Exp. Bot. 4: 296-313.

MARTIN, E. J. and L. W. WEINBERGER. 1966. Eutrophication and water pollution. Proc. 9th Conf. Great Lakes Res., p. 451-469. Univ. Michigan, Great Lakes Res. Div., Pub. No. 15.

McCARTER, J. A., F. R. HAYES, L. H. JODREY and M. L. CAMERON. 1952. Movement of materials in the hypolimnion of lakes as studied by addition of radioactive phosphorus. Canadian J. Zool. Vol. 30.

McCOMBIE, A. M. 1967. A recent study of the phytoplankton of the Bay of Quinte 1963-1964. Proc. 10th Conf. Great Lakes Res., p. 37-62. Internat. Assoc. Great Lakes Res.

MICHALSKI, M. F. P. 1968. Phytoplankton levels in Canadian near-shore waters of the lower Great Lakes. Proc. 11th Conf. Great Lakes Res., p. 85-95. Internat. Assoc. Great Lakes Res.

MICHIGAN GRAND RIVER WATERSHED COUNCIL. April 1972. Stream Monitoring Program Report. 16 p.

MICHIGAN WATER RESOURCES COMMISSION. 1970. Great Lakes Algae Monitoring Program 1969. 16 p.

MOSS, B. 1969. Vertical heterogeneity in the water column of Abbott's Pond. II. J. Ecology 57: 394-411.

MURPHY, J. and J. P. RILEY. 1962. A modified single solution method for the determination of phosphate in natural waters. Anal. Chem. Acta. 27: 31.

NOBLE, V. E. and R. F. ANDERSON. 1968. Temperature and current structure in the Grand Haven, Michigan, vicinity during thermal bar conditions. Proc. 11th Conf. Great Lakes Res., p. 424-436. Internat. Assoc. Great Lakes Res.

PALMER, C. M. 1964. Algae in water supplies of the U. S., p. 239-261. In D. F. Jackson [ed.], Algae and Man. New York, Plenum Press.

PARSONS, R. T., K. STEPHENS and M. TAKAHASHI. 1972. The fertilization of Great Central Lake. I. Effect of primary production. Fish. Bull. 70: 13-23.

PATRICK, R. 1948. Factors effecting the distribution of diatoms. Bot. Review 14: 473-524.

_______ and C. W. Reimer. 1966. The diatoms of the United States exclusive of Alaska and Hawaii. Vol. 1. Monographs of the Academy of Natural Sciencies of Philadelphia, No. 13, 688 p.

PEARSALL, W. H. 1932. Phytoplankton in the English Lakes. II. The composition of the phytoplankton in relation to dissolved substances. J. Ecology 20: 241-262.

POWERS, C. F. and J. C. AYERS. 1967. Water quality and eutrophication in southern Lake Michigan, p. 142-178. In J. C. Ayers and D. C. Chandler, Studies on the environment and eutrophication of Lake Michigan. Univ. Michigan, Great Lakes Res. Div., Spec. Rep. 30.

RAWSON, D. S. 1956. Algal indicators of trophic lake types. Limnol. Oceanogr. 1: 18-25.

RICE, C. H. 1938. Studies in the phytoplankton of the River Thames (1928-32) I and II. Annals of Botany, New Series, 2(7): 539-577, 579-581.

RISLEY, C. Jr. and F. D. FULLER. 1965. Chemical characteristics of Lake Michigan. Proc. 8th Conf. Great Lakes Res., p. 168-174. Univ. Michigan, Great Lakes Res. Div. Pub. 13.

RODHE, W. 1948. Environmental requirements of planktonic algae. Symb. Bot. Upsal. 10: 149.

SAWYER, C. N. 1947. Fertilization of lakes by agricultural and urban drainage. J. New England Water Works Assoc. 61: 109-127.

SCHELSKE, C. L. and E. CALLENDER. 1970. Survey of phytoplankton productivity and nutrients in Lake Michigan and Lake Superior. Proc. 13th Conf. Great Lakes Res., p. 93-105. Internat. Assoc. Great Lakes Res.

_______ and E. F. STOERMER. 1971. Eutrophication, silica depletion, and predicted changes in algal quality in Lake Michigan. Science 173: 423-424.

_______, E. F. STOERMER and L. E. FELDT. 1971. Nutrients, phytoplankton productivity and species composition as influenced by upwelling in Lake Michigan. Proc. 14th Conf. Great Lakes Res., p. 102-113, Internat. Assoc. Great Lakes Res.

_______, and E. F. STOERMER. 1972. Phosphorus, silica and eutrophication in Lake Michigan, p. 157-171. In G. E. Likens [ed.], Nutrients and eutrophication. Spec. Symposia Vol. 1, Amer. Soc. Limnol. Oceanogr., Lawrence, Kansas.

_______, L. E. FELDT, M. A. SANTIAGO and E. F. STOERMER. 1972. Nutrient enrichment and its effect on phytoplankton production and species composition in Lake Superior. Proc. 15th Conf. Great Lakes Res., p. 149-165. Internat. Assoc. Great Lakes Res.

_______. In press (a). Nutrient inputs and their relationship to accelerated eutrophication in Lake Michigan. Proc. Third Int. Symposium for Hydrology Professors, Purdue University.

_______. In press (b). Silica and nitrate depletion as related to eutrophication in Lake Michigan, Lake Huron, and Lake Superior. Proc. Symp. Interactions Between Land and Water, Internat. Assoc. Ecol. and Soc. Internat. Limnol.

SCHENK, C. F. and R. E. THOMPSON, 1965. Long-term changes in water chemistry and abundance of plankton at a single sampling location in Lake Ontario. Proc. 8th Conf. Great Lakes Res., p. 197-208. Univ. Michigan, Great Lakes Res. Div. Pub. 13.

SCHROEDER, H. 1939. Die Algenflora der Mulde. Pflanzenforschung, Vol. 21: 1-88.

STEPHENS, K. 1963. Determination of low phosphate concentrations in lake and marine water. Limnol. Oceanogr. 8: 361-362.

STOERMER, E. F. 1967. An historical comparison of offshore phytoplankton populations in Lake Michigan, p. 47-77. In J. C. Ayers and D. C. Chandler, Studies on the environment and eutrophication of Lake Michigan. Univ. Michigan, Great Lakes Res. Div., Spec. Rep. No. 30.

_______ and E. KOPCZYNSKA. 1967. Phytoplankton populations in the extreme southern basin of Lake Michigan, 1962-1963. Proc. 10th Conf. Great Lakes Res., p. 88-106. Internat. Assoc. Great Lakes Res.

_______. 1968. Nearshore phytoplankton populations in the Grand Haven, Michigan vicinity during thermal bar conditions. Proc. 11th Conf. Great Lakes Res., p. 137-150. Internat. Assoc. Great Lakes Res.

_______ and J. J. YANG. 1969. Plankton diatom assemblages in Lake Michigan. Univ. Michigan, Great Lakes Res. Div., Spec. Rep. No. 47, 268 p.

_______ and ____. 1970. Distribution and relative abundance of dominant plankton diatoms in Lake Michigan. Univ. Michigan, Great Lakes Res. Div., Pub. No. 16, 64 p.

_______, C. L. SCHELSKE and L. E. FELDT. 1971. Phytoplankton assemblage differences at inshore versus offshore stations in Lake Michigan and their effects on nutrient enrichment experiments. Proc. 14th Conf. Great Lakes Res., p. 114-118. Internat. Assoc. Great Lakes Res.

_______, _________, M. A. SANTIAGO and L. E. FELDT. 1972. Spring phytoplankton abundance and productivity in Grand Traverse Bay, Lake Michigan, 1970. Proc. 15th Conf. Great Lakes Res., p. 181-191. Internat. Assoc. Great Lakes Res.

SWALE, E. M. F. 1964. A study of the phytoplankton of a calcareous river. J. Ecology 52: 433-446.

_____. 1969. Phytoplankton in two English rivers. J. Ecology 57: 1-23.

TEILING, E. 1955. Algae. Some mesotrophic phytoplankton indicators. Proc. Int. Assoc. Limnol. 12: 212-215.

VAUGHAN, R. D. and G. L. HARLOW. 1965. Report on pollution of the Detroit River, Michigan waters of Lake Erie, and their tributaries. U.S.D. H.E.W., Public Health Service, Div. of Water Supply and Pollution Control. 341 p.

VAUGHN, J. C. 1961. Coagulation difficulties at the South District Filtration Plant. Pure Water 13: 45-49.

WAWRIK, F. 1962. Zur Frage; Führt der Donaustrom autochthones Plankton? Arch. Hydrobiol. Suppl. 27: 28-55.

WHITFORD, L. A. and G. J. SCHUMACHER. 1963. Communities of algae in North Carolina streams and their seasonal relations. Hydrobiologia 22(1/2): 133-196.

WILLIAMS, L. G. and G. SCOTT. 1962. Principal diatoms of major waterways of the United States. Limnol. Oceanogr. (7): 365-379.

_______. 1964. Possible relationships between plankton-diatom species numbers and water-quality estimates. Ecology 45: 809-823.

WUJEK, D. E. 1967. Some plankton diatoms from the Detroit River and western Lake Erie adjacent to the Detroit River. Ohio J. Sci. 67: 32-35.

WUNDSCH, H. H. 1920. Beiträge zur Frage nach dem Einfluss von Temperatur und Ernährung auf die quantitative Entwicklung von Süsswasser Organismen. Zool. Jahrb. Abt. f. Allg. Zool. Physiol. 38: 1-48.

SPATIAL AND TEMPORAL VARIATIONS IN PHYTOPLANKTON AND ASSOCIATED ENVIRONMENTAL FACTORS IN THE GRAND RIVER OUTLET AND ADJACENT WATERS OF LAKE MICHIGAN

Volume II

Appendix

by
Elżbieta Ewa Kopczyńska

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Oceanography)
in The University of Michigan
1973

Doctoral Committee:

Professor John C. Ayers, Chairman
Professor Francis C. Evans
Professor Jack L. Hough
Doctor Eugene F. Stoermer, Great Lakes Research Division,
The University of Michigan

LIST OF ILLUSTRATIONS

Figure		Page
1	Locations of sampling stations and of the visible river plume.	196
2	Surface and bottom phytoplankton counts and concentrations of nutrients. September 1968.	205
3	Surface and bottom phytoplankton counts and concentrations of nutrients. October 1968.	208
4	Average phytoplankton counts and concentrations of nutrients. November 1968.	212
5	Surface and bottom phytoplankton counts and concentrations of nutrients. March 1969.	214
6	Average phytoplankton counts and concentrations of nutrients. April 1969.	217
7	Average phytoplankton counts and concentrations of nutrients. May 1969.	219
8	Average phytoplankton counts and concentrations of nutrients. June 1969.	221
9	Surface and bottom phytoplankton counts and concentrations of nutrients. July 1969.	223
10	Surface, bottom and average phytoplankton counts and concentrations of nutrients. August 1969.	227
11	Phytoplankton, nutrients and physical data, the Grand River, September 1968 to August 1969.	233
12	Phytoplankton, nutrients and physical data, the inshore lake stations, September 1968 to August 1969.	238
13	Phytoplankton, nutrients and physical data, the middle of the river plume, September 1968 to August 1969.	241
14	Phytoplankton, nutrients and physical data, the edge of the river plume, September 1968 to August 1969.	244

LIST OF TABLES

Table		Page
1	Dominant Species and Genera of Diatoms Found in the River and Lake Survey Stations. Estimated Numbers of Cells in 1 ml of Sample.	247
2	Relative Abundance of Diatoms in Total Phytoplankton.	257
3	Estimated Numbers of Greens, Bluegreens, Chrysophyta, Pyrrophyta and Flagellates. Units in 1 ml of Sample.	383
4	Phytoplankton, Numbers of Identified Taxa.	437
5	Physical Data and Average Chemical Results.	446
6	Individual Chemical Values and Temperature Measurements.	455
7	Physical and Chemical Results; Averages and Ranges in the Four Areas of Studies, Mouth of the Grand River, the River Discharge and Adjacent Waters of Lake Michigan, September 1968 to August 1969.	479
8	Dominant Diatoms and Major Algal Groups: Estimated Numbers of Units in 1 ml of Sample; Averages and Ranges, September 1968 to August 1969.	480
9	Coefficients of Selected Regression Equations.	483

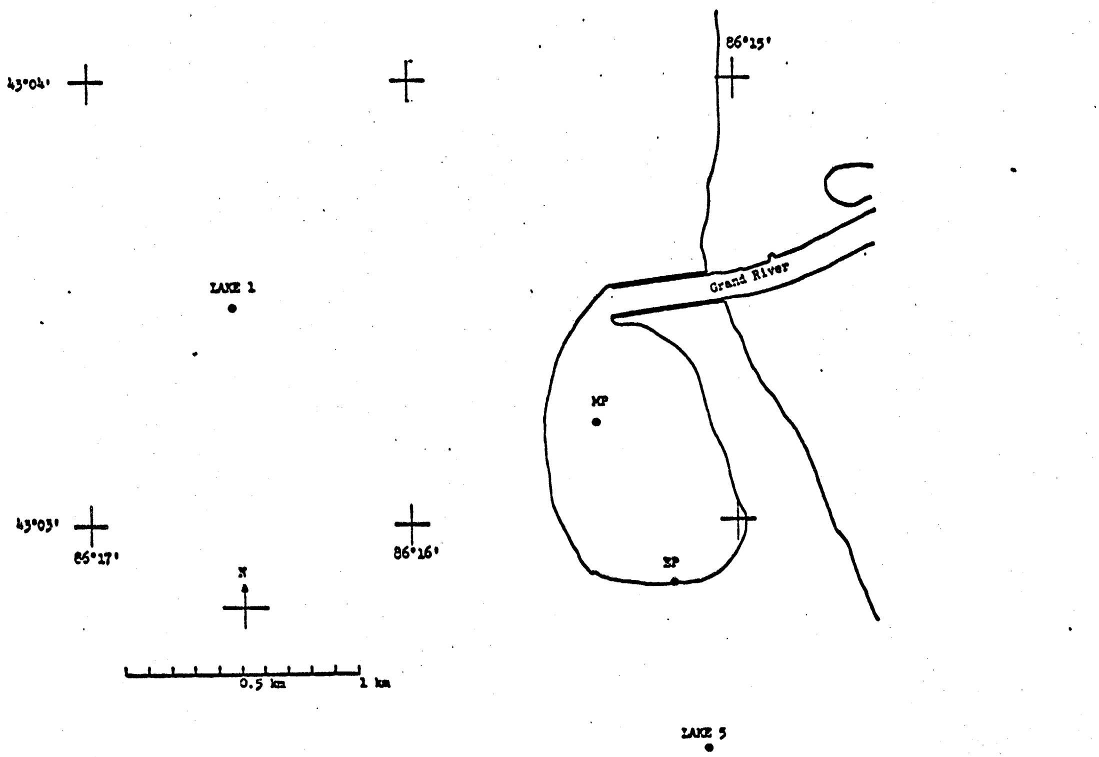

Fig. 1a Locations of sampling stations and of the visible river plume, September 26, 1968.

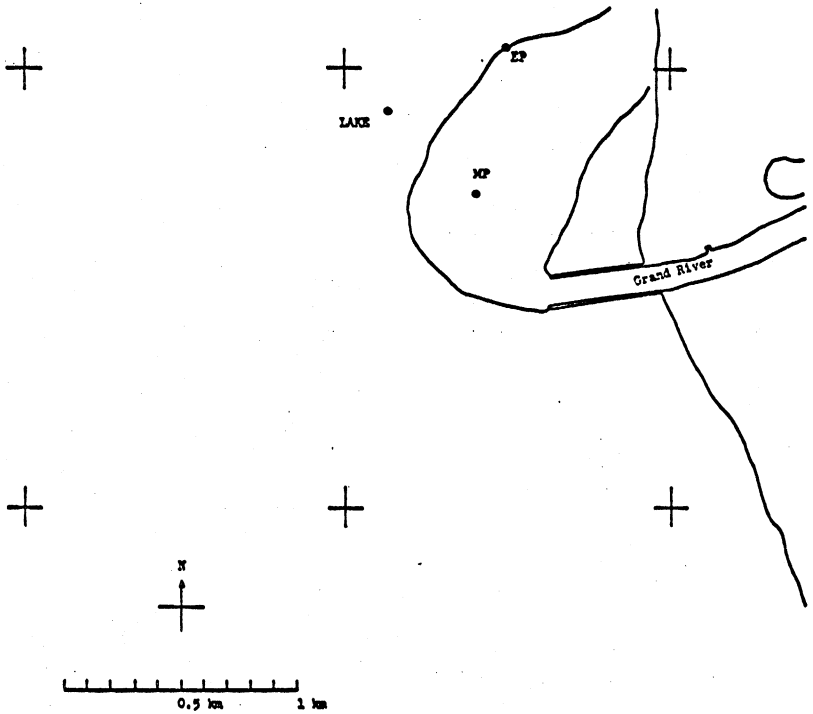

Fig. 1b Locations of sampling stations and of the visible river plume, October 15, 1968.

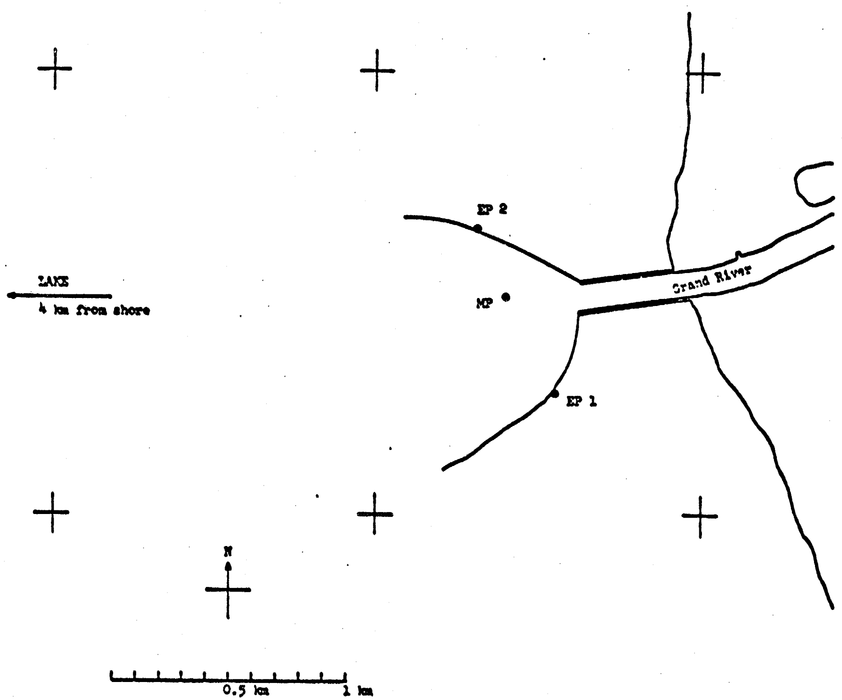

Fig. 1c Locations of sampling stations and of the visible river plume, November 6, 1968.

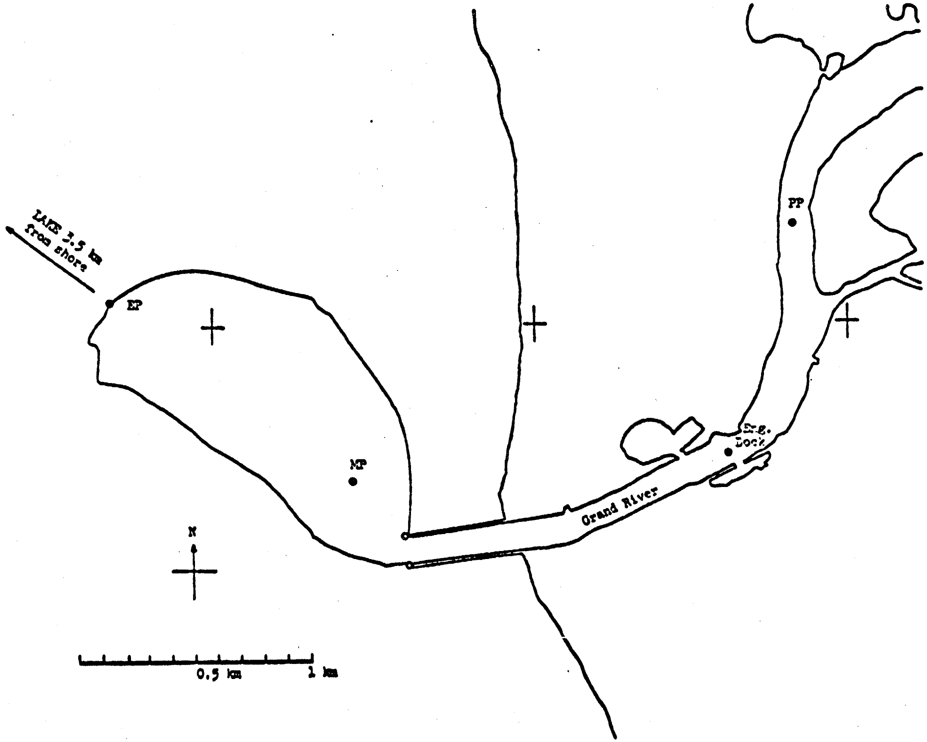

Fig. 1d Locations of sampling stations and of the visible river plume, March 18, 1969.

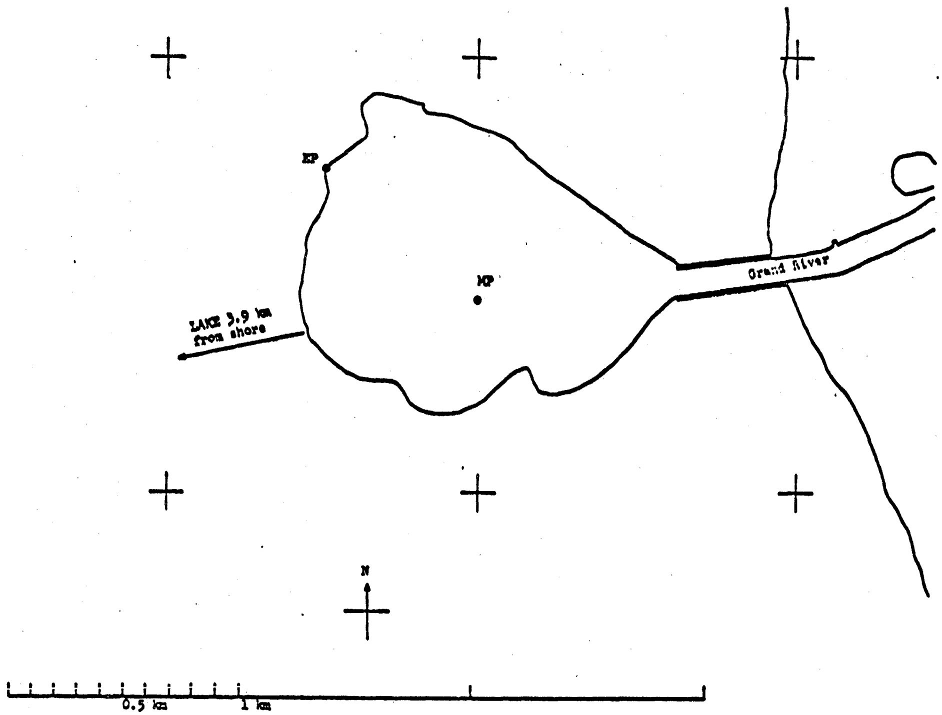

Fig. 1e Locations of sampling stations and of the visible river plume, April 17, 1969.

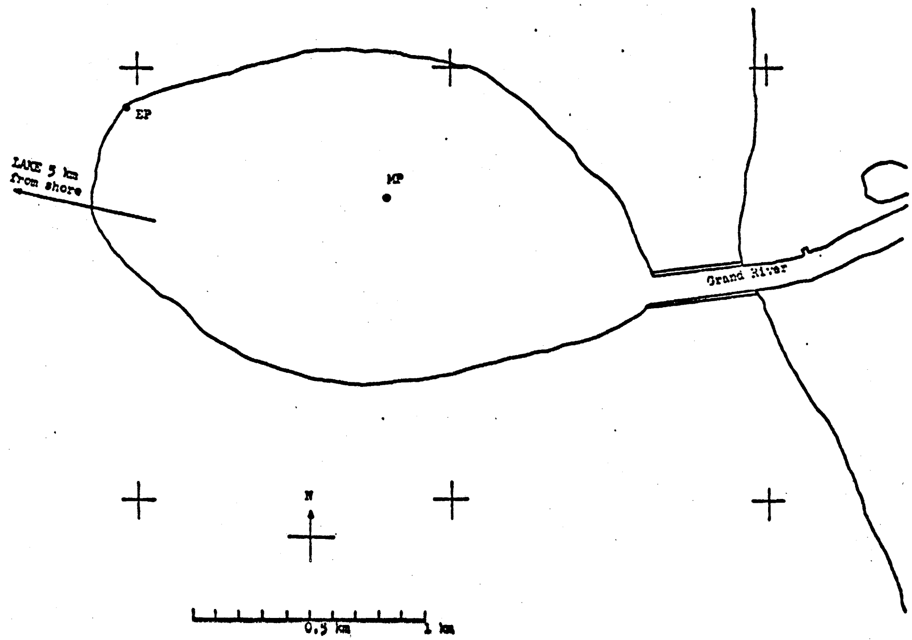

Fig. 1f Locations of sampling stations and of the visible river plume, May 29, 1969.

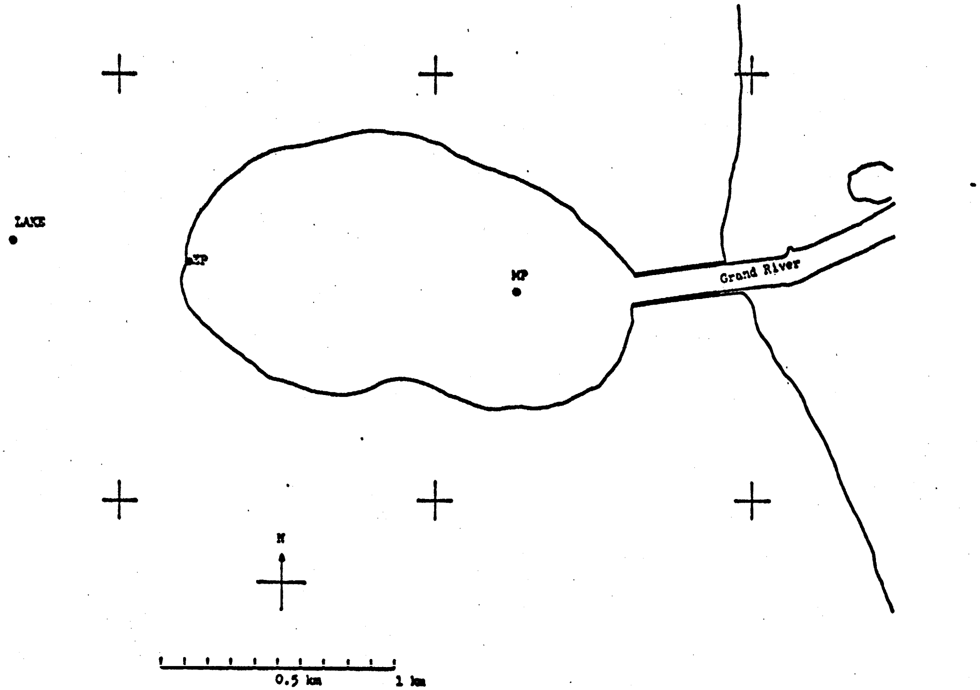

Fig. 1g Locations of sampling stations and of the visible river plume, June 23, 1969.

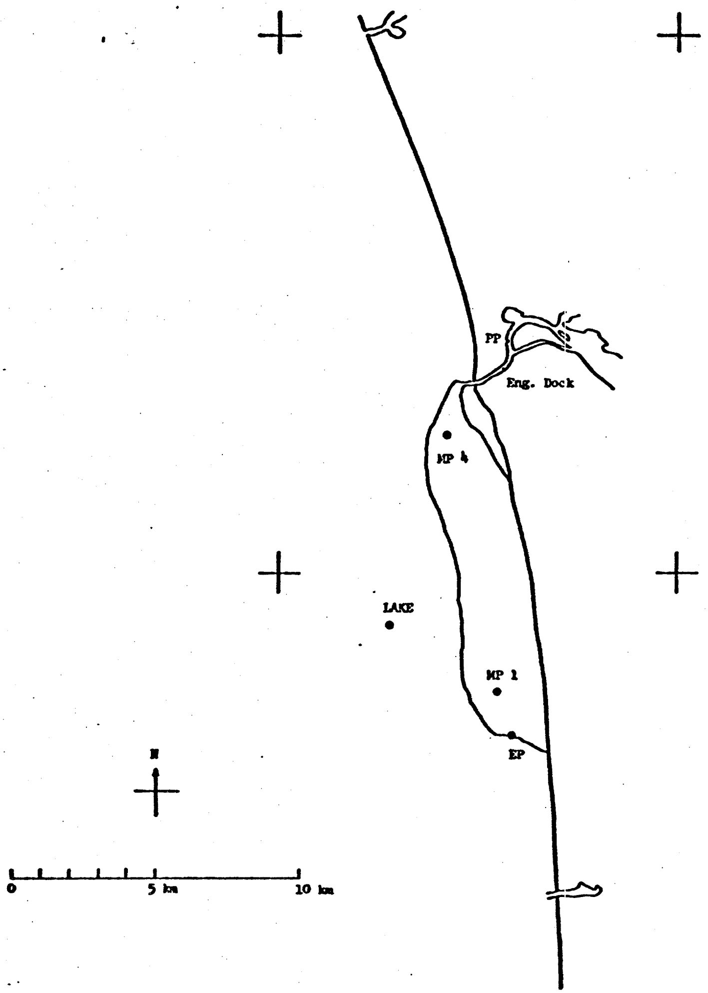

Fig. 1h Locations of sampling stations and of the visible river plume, July 25, 1969.

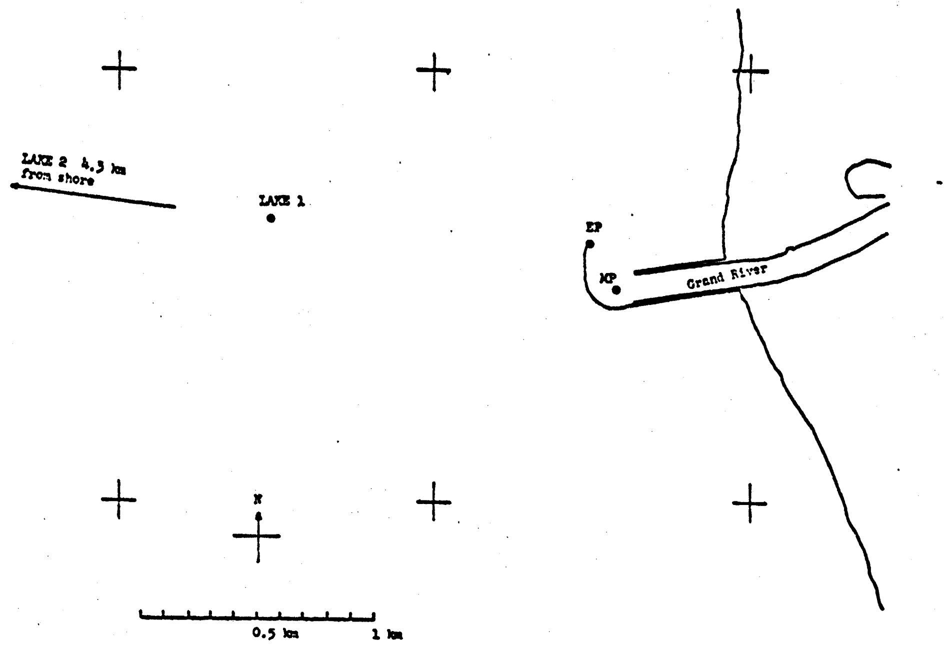

Fig. 11 Locations of sampling stations and of the visible river plume, August 29, 1969.

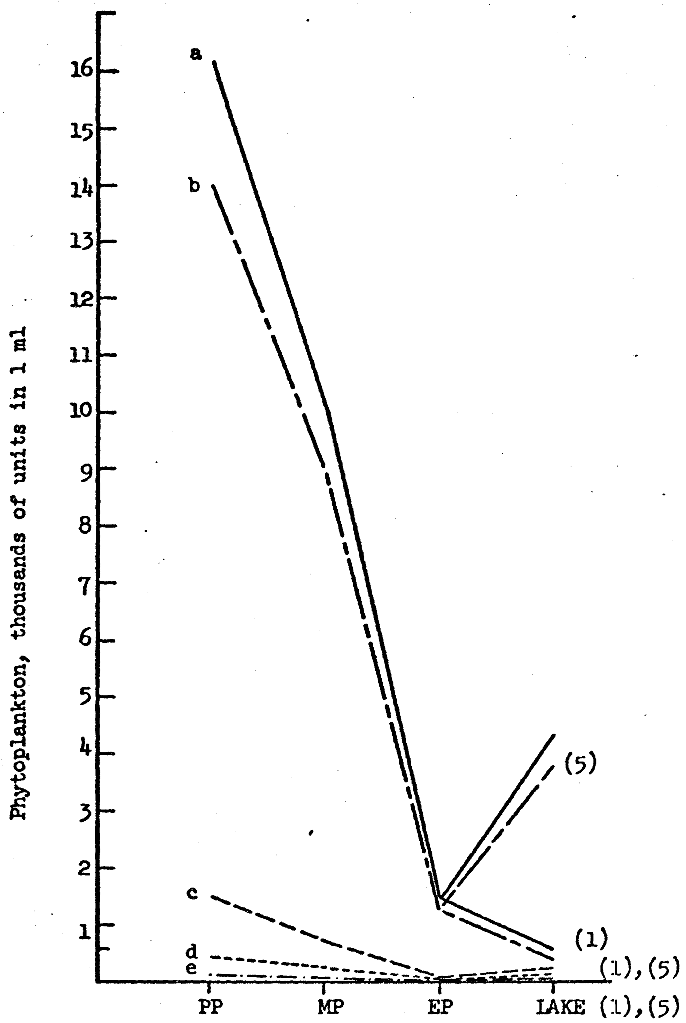

Fig. 2a Surface phytoplankton counts, September 26, 1968.

a - total algae; b - diatoms; c - greens; d - flagellates;

e - bluegreens.

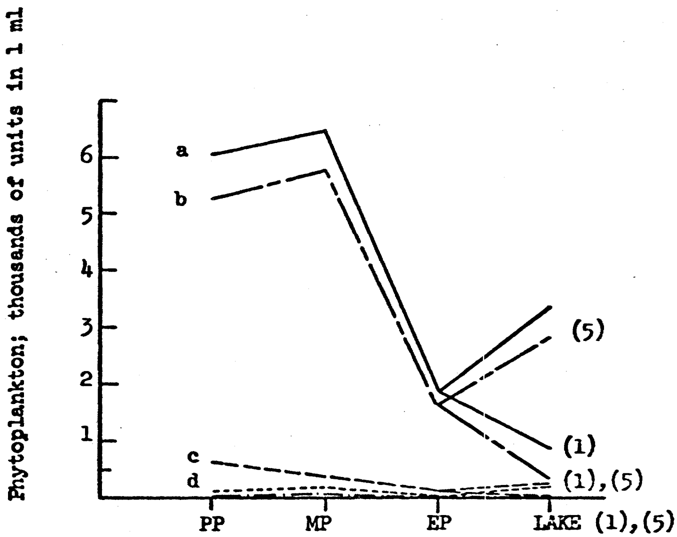

Fig. 2b Bottom phytoplankton counts, September 26, 1968.

a - total algae; b - diatoms; c - greens; d - flagellates.

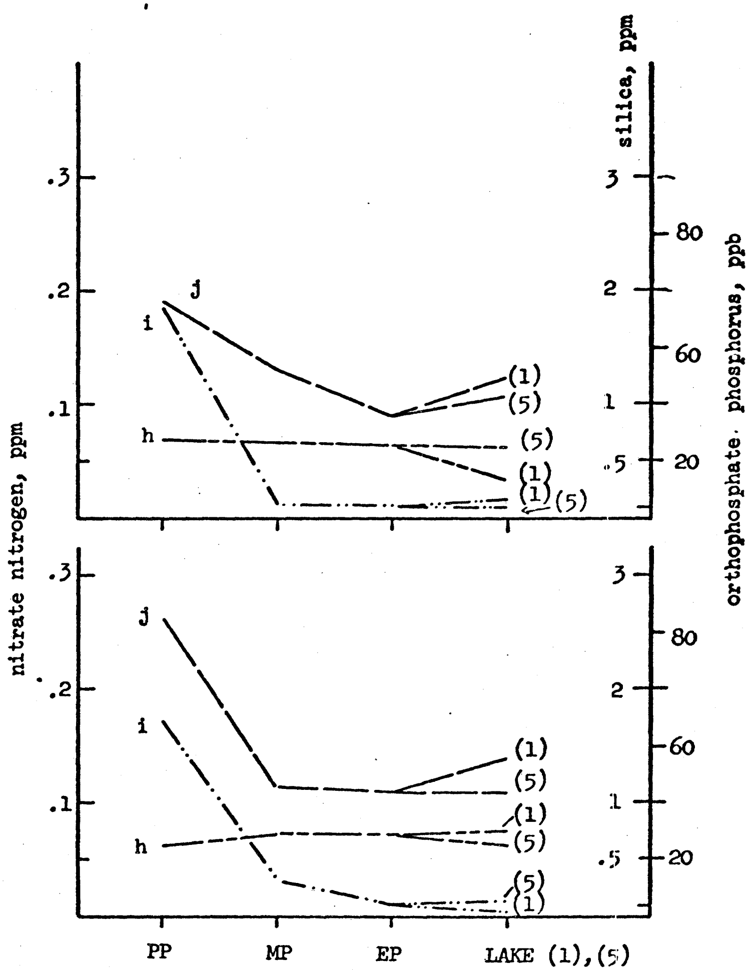

Fig. 2c (upper) Surface concentration of: h - silica; i - orthophosphate; j - nitrate nitrogen.

Fig. 2d (lower) Bottom values. September 26, 1968.

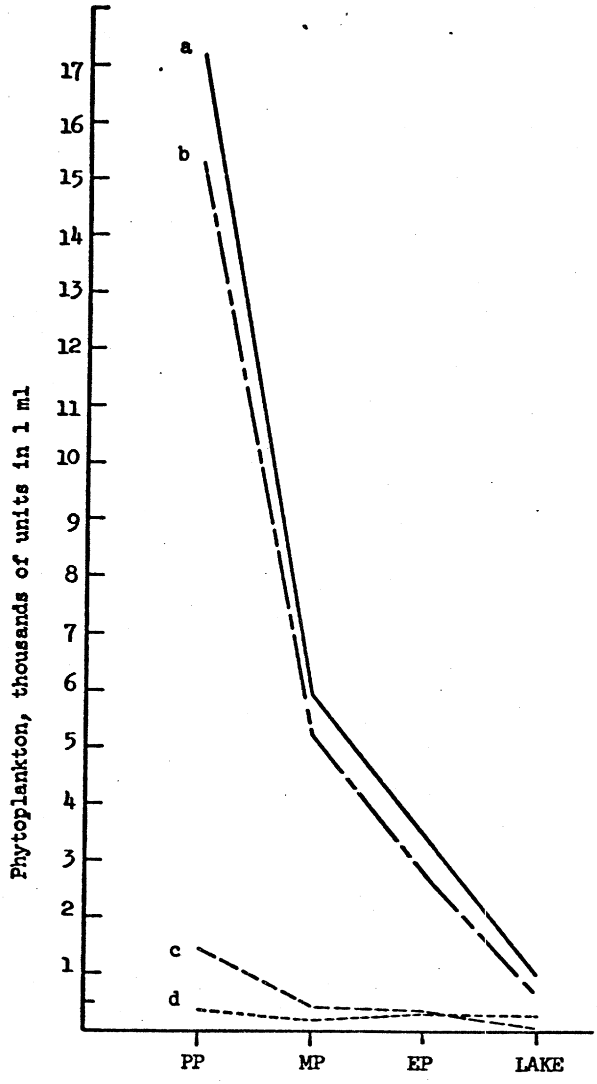

Fig. 3a Surface phytoplankton counts, October 15, 1968. a - total algae; b - diatoms; c - greens; d - flagellates.

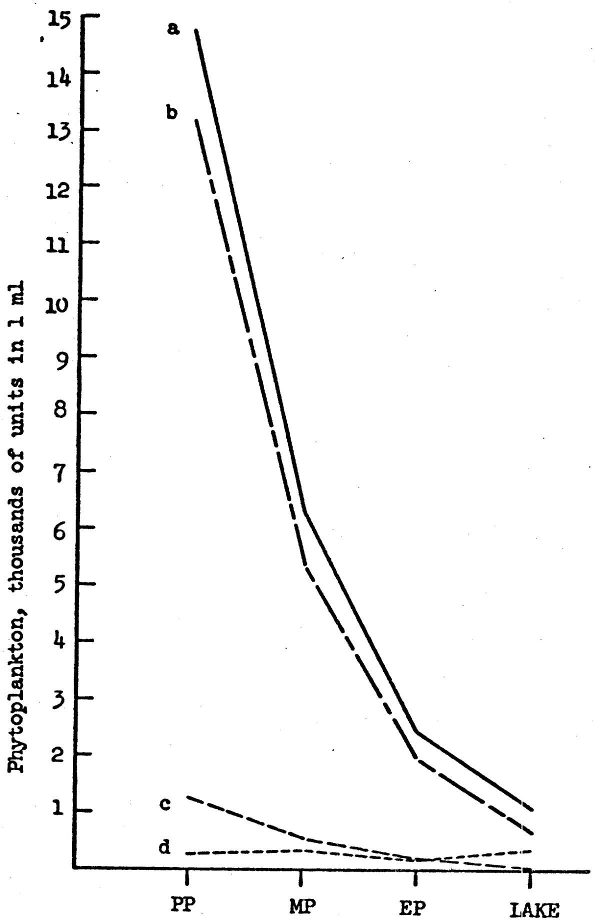

Fig. 3b Bottom phytoplankton counts, October 15, 1968. a - total algae; b - diatoms; c - greens; d - flagellates.

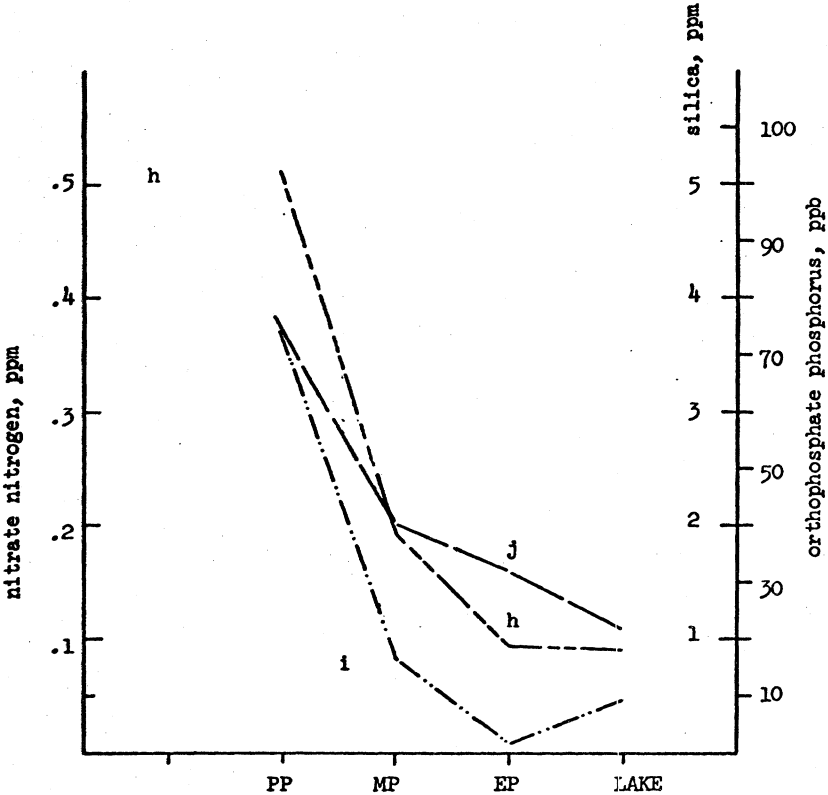

Fig. 3c Surface concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. October 15, 1968.

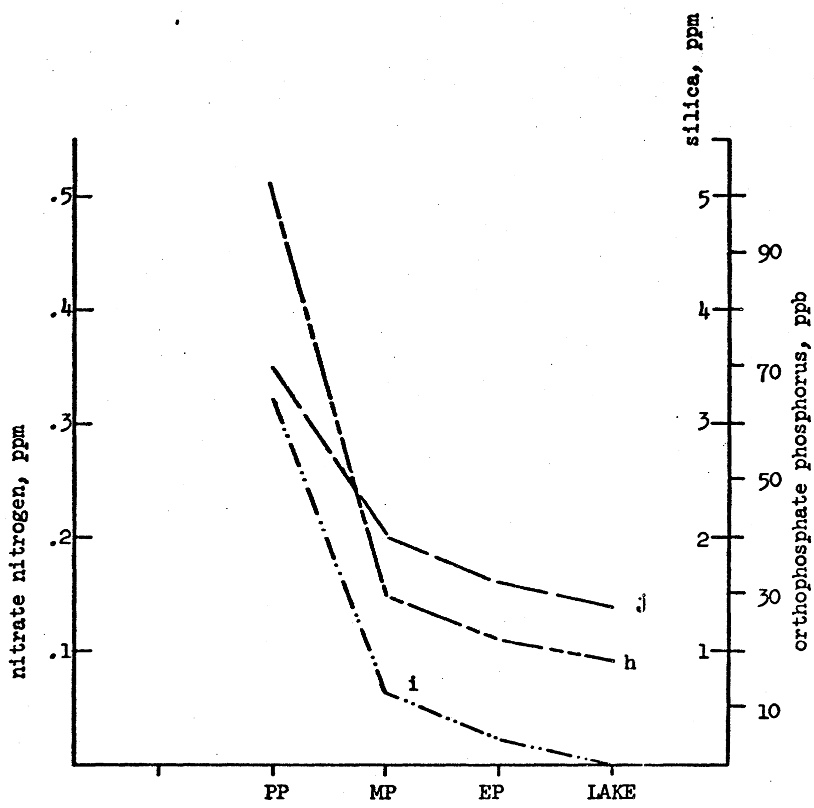

Fig. 3d Bottom concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. October 15, 1968.

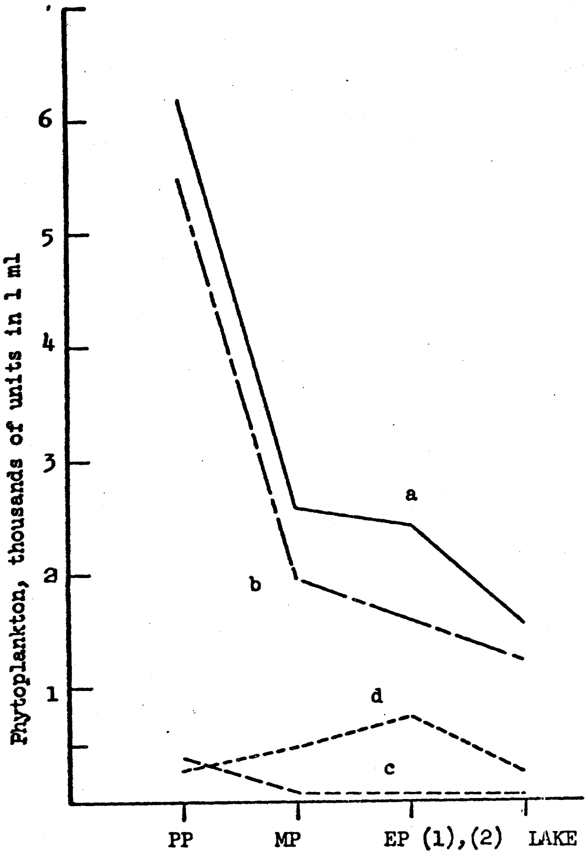

Fig. 4a Average phytoplankton counts, November 6, 1968. a - total algae; b - diatoms; c - greens; d - flagellates.

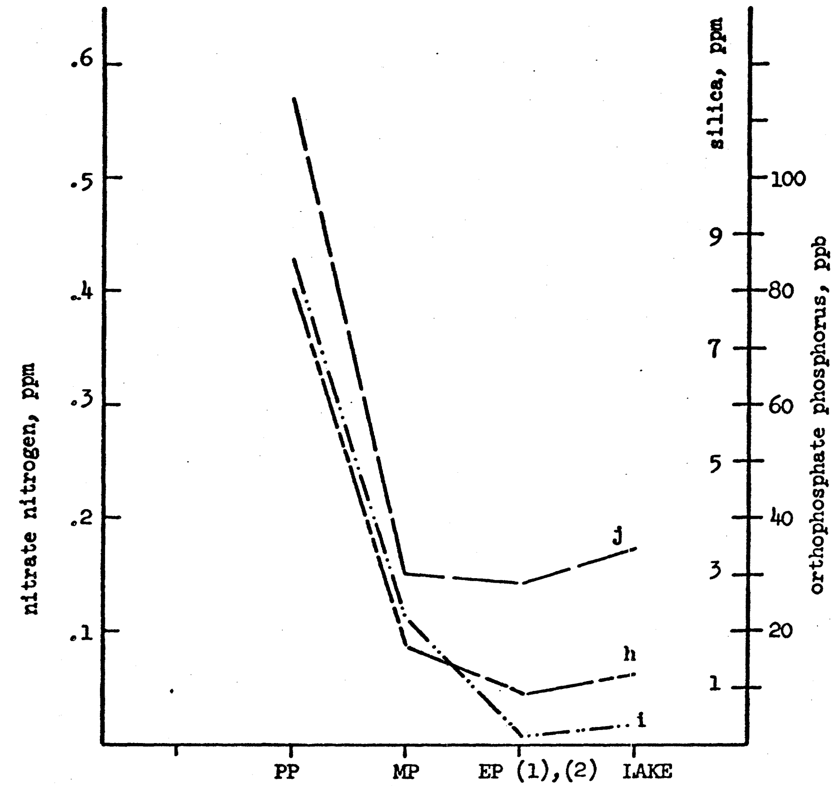

Fig. 4b Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. November 6, 1968.

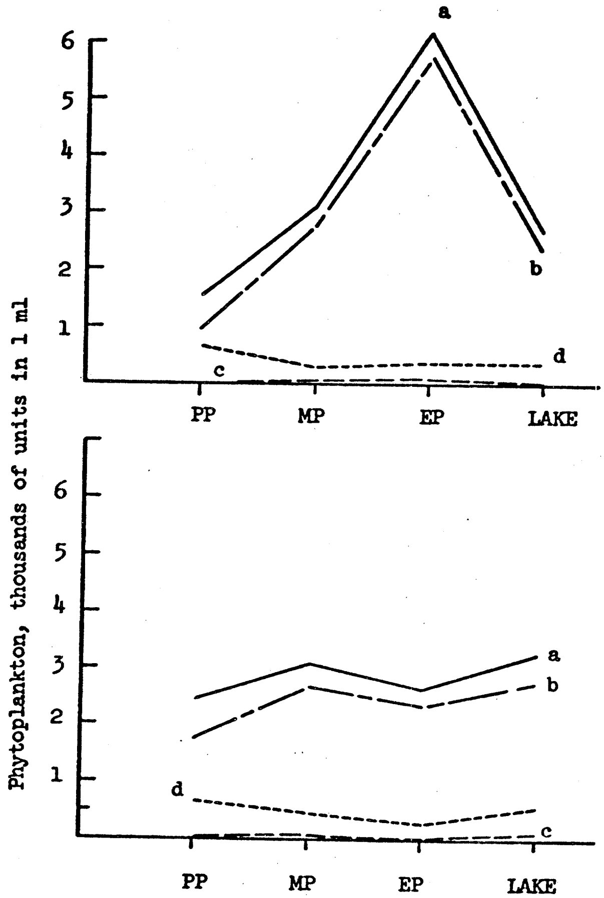

Fig. 5a (upper) Surface phytoplankton counts.

Fig. 5b (lower) Bottom phytoplankton counts. a - total algae; b - diatoms; c - greens; d - flagellates. March 18, 1969.

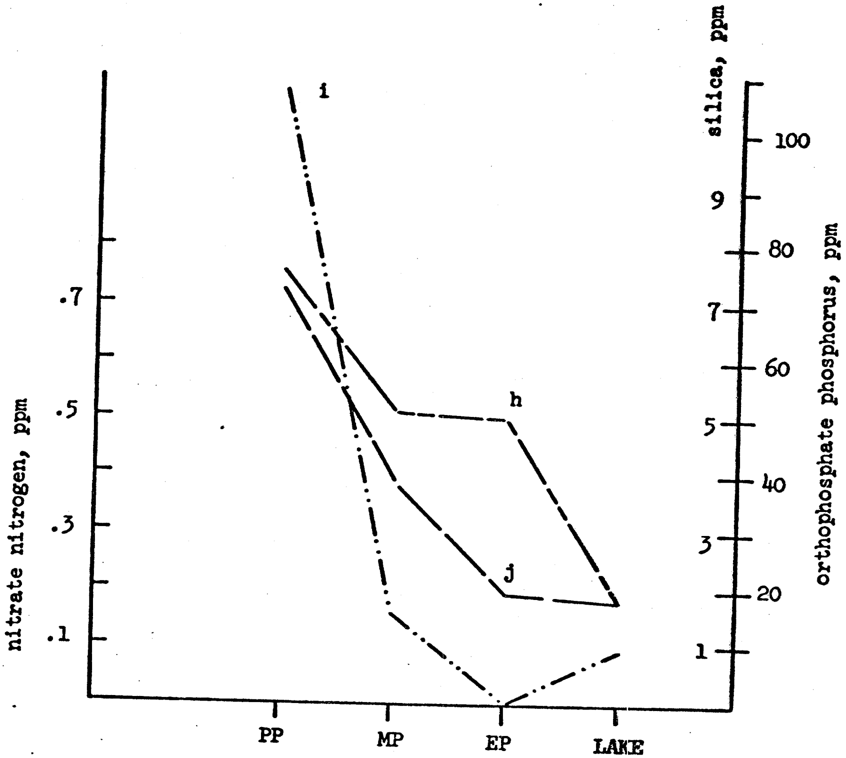

Fig. 5c Surface concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. March 18, 1969.

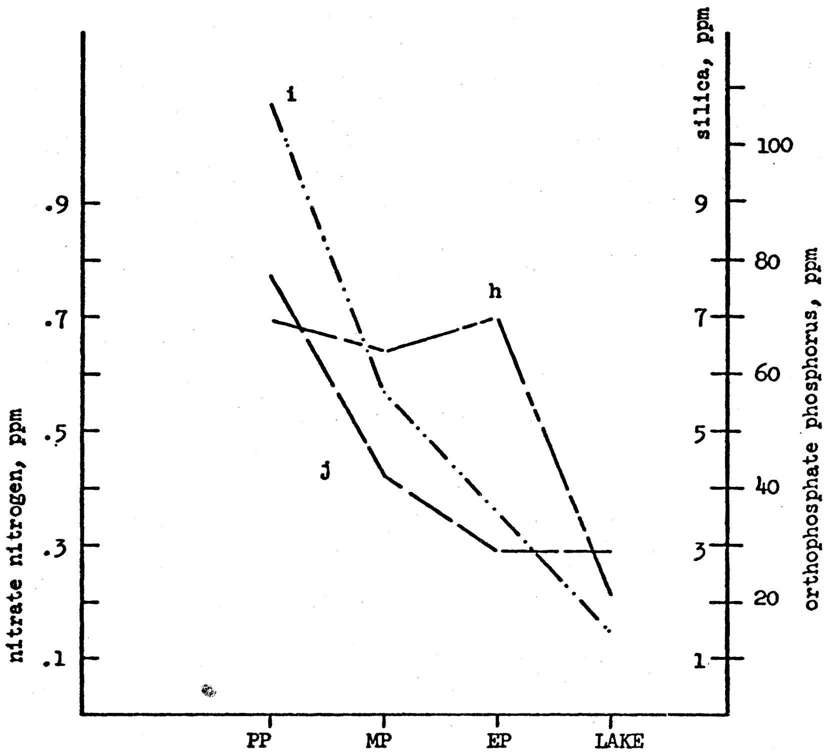

Fig. 5d Bottom concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. March 18, 1969.

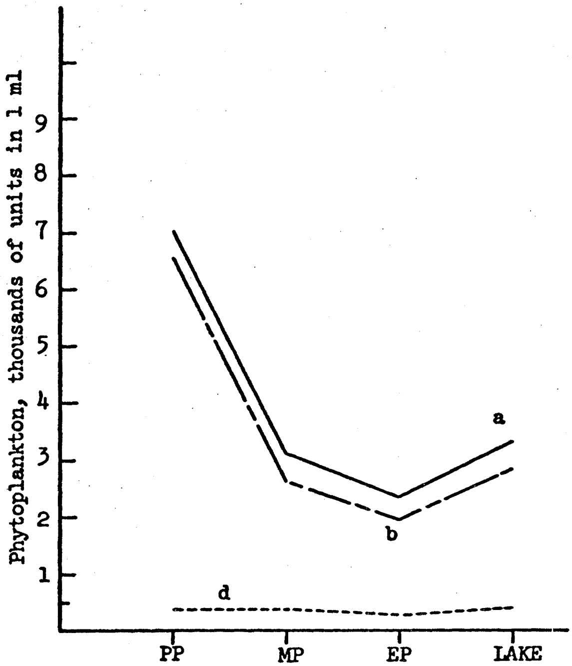

Fig. 6a Average phytoplankton counts, April 17, 1969. a - total algae; b - diatoms; d - flagellates.

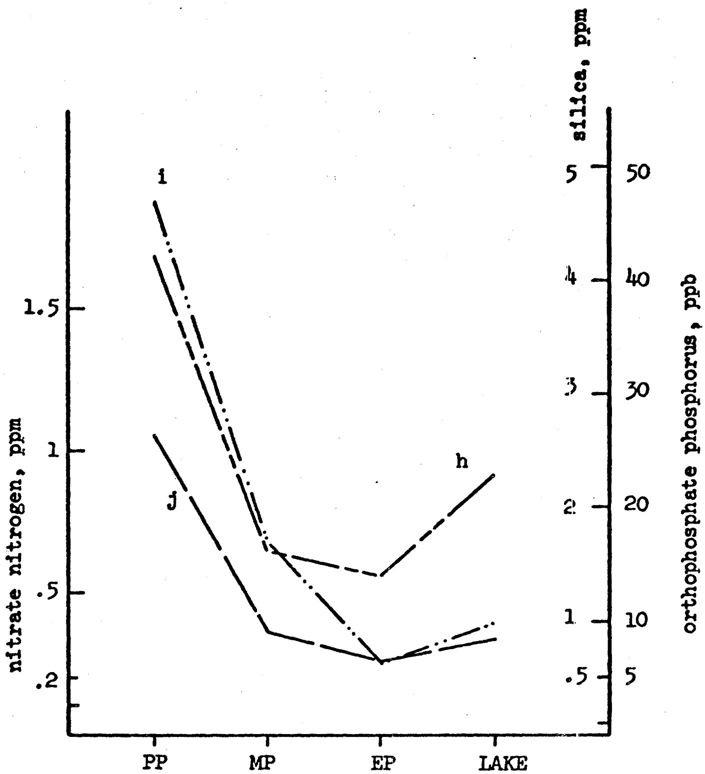

Fig. 6b Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. April 17, 1969.

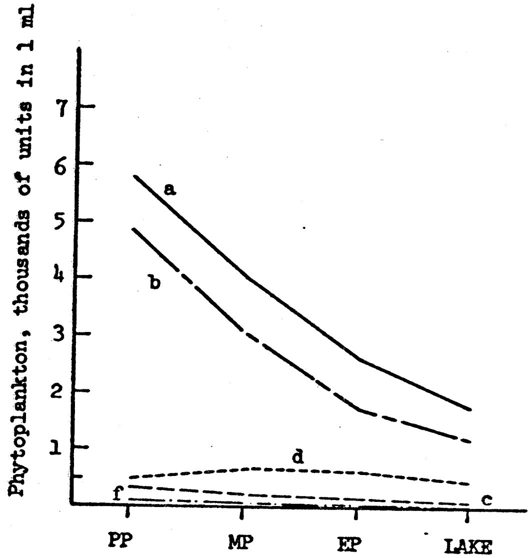

Fig. 7a Average phytoplankton counts, May 29, 1969. a - total algae; b - diatoms; c - greens; d - flagellates; f - Chrysophyta.

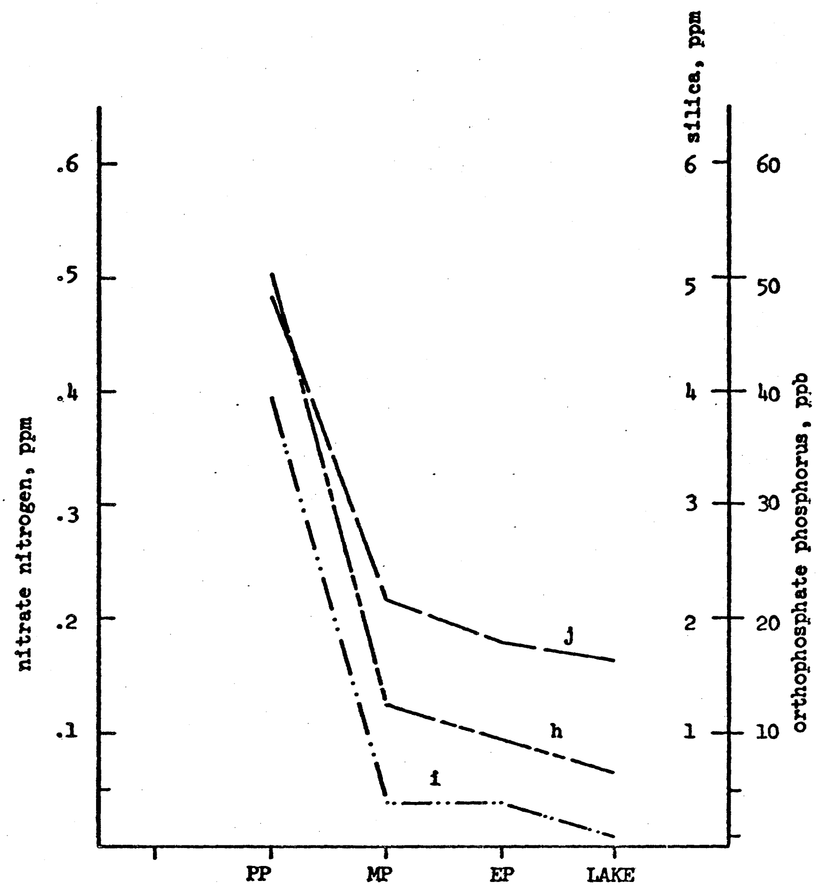

Fig. 7b Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitorgen. May 29, 1969.

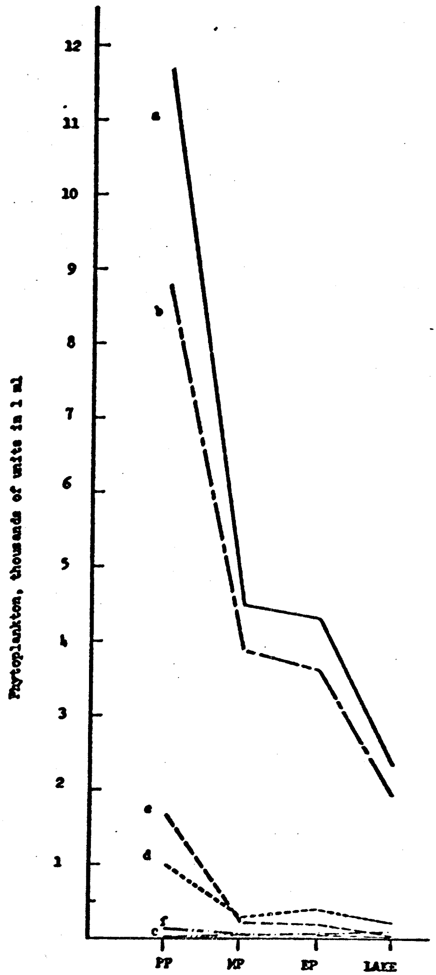

Fig. 8a Average phytoplankton counts, June 23, 1969. a - total algae; b - diatoms; c - greens; d - flagellates; e - blue greens, f - Chrysophyta.

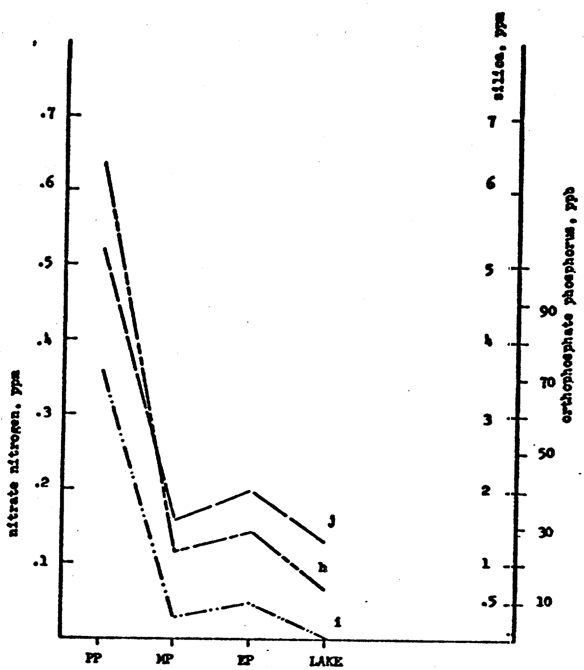

Fig. 8b Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. June 23, 1969.

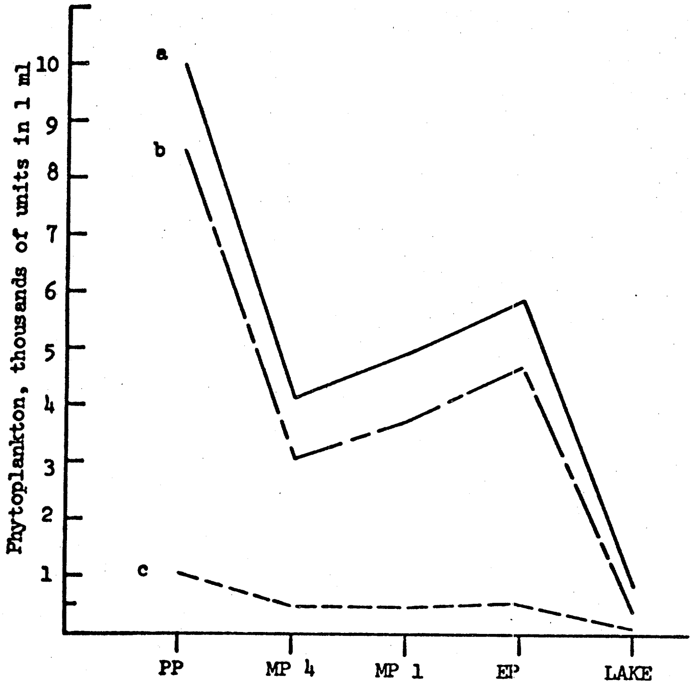

Fig. 9a Surface phytoplankton counts. July 25, 1969. a - total algae; b - diatoms; c - greens.

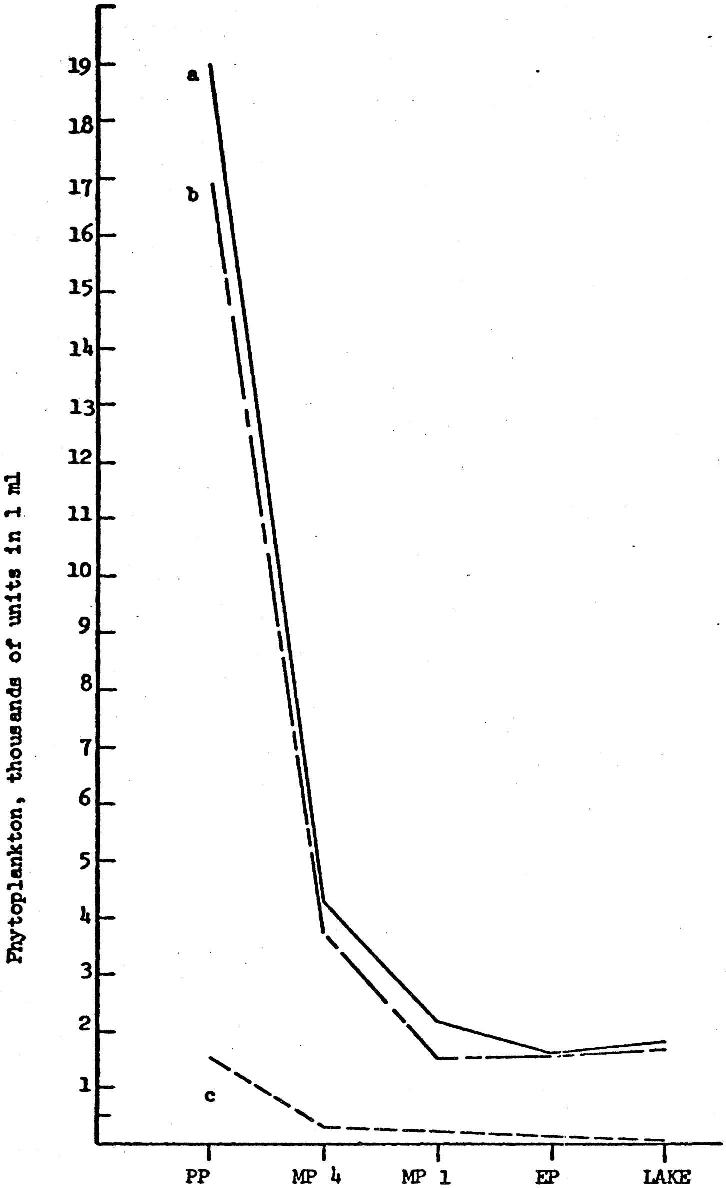

Fig. 9b Bottom phytoplankton counts. July 25, 1969. a - total algae; b - diatoms; c - greens.

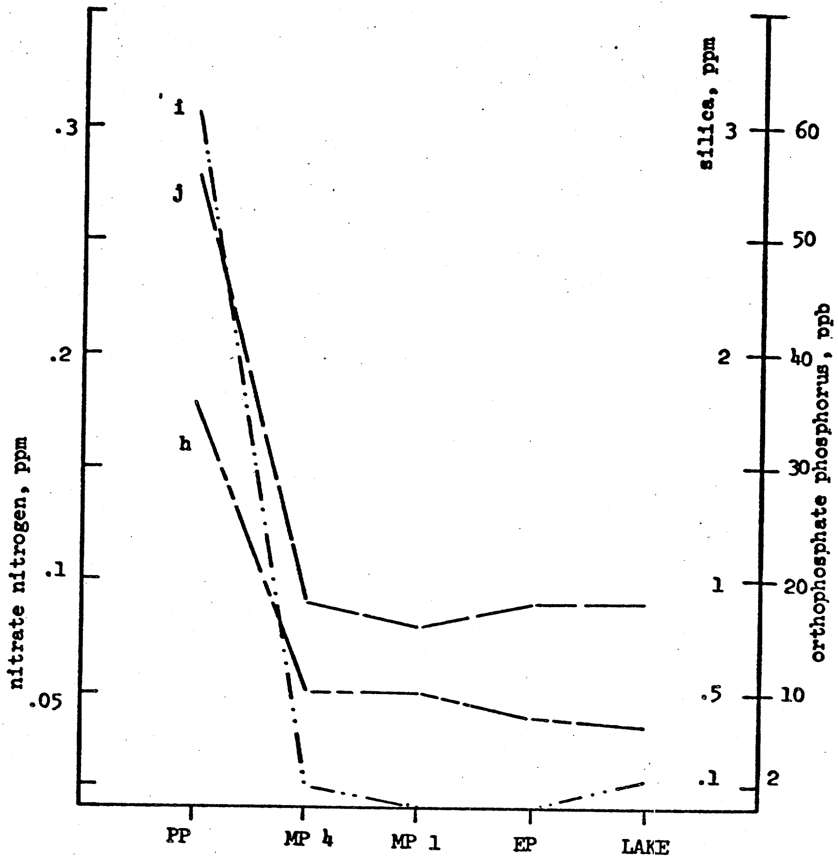

Fig. 9c Surface concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. July 25, 1969.

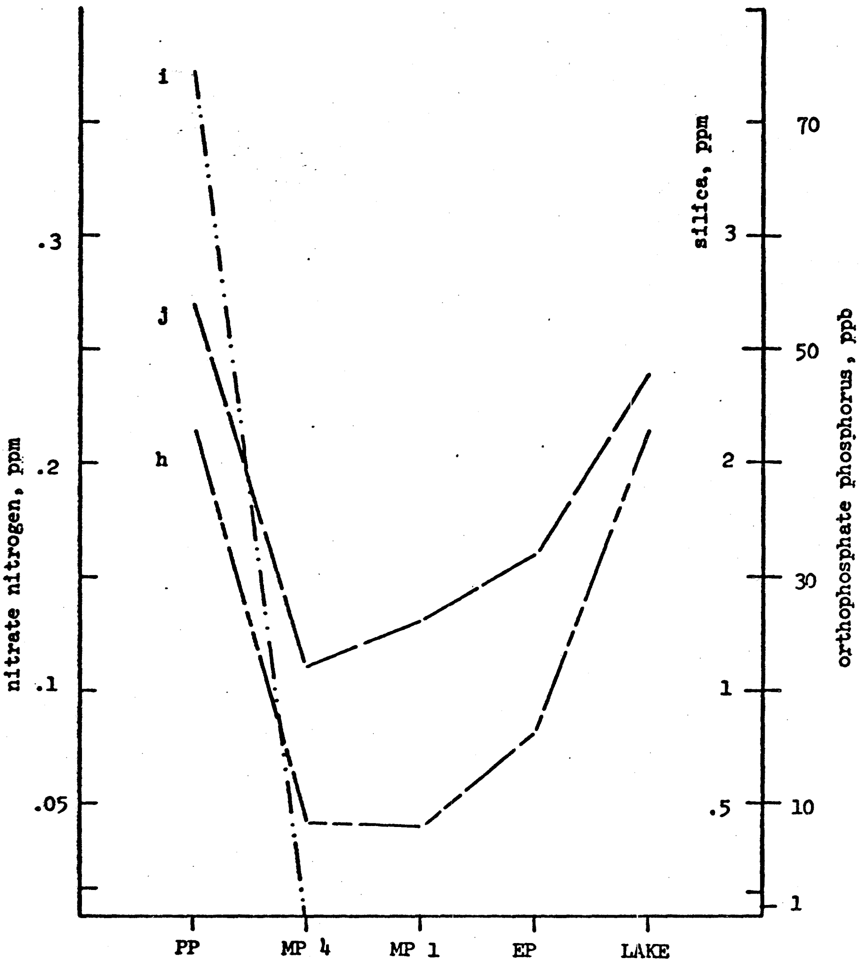

Fig. 9d Bottom concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. July 25, 1969.

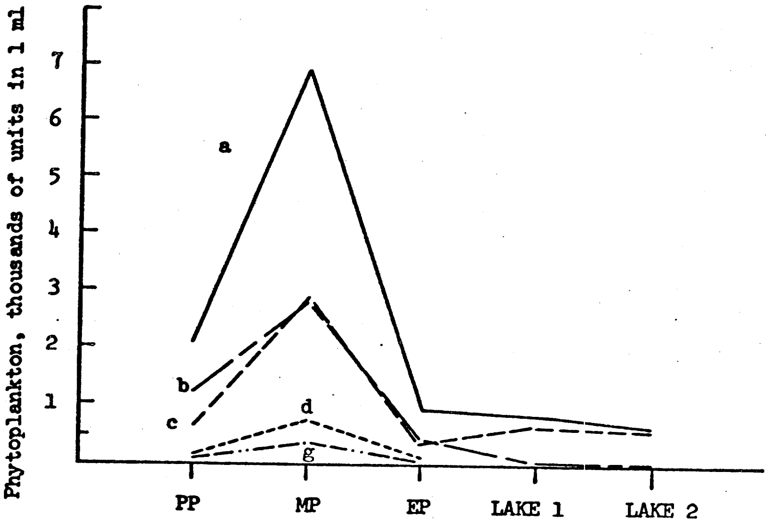

Fig. 10a Surface phytoplankton counts. August 29, 1969. a - total algae; b - diatoms; c - greens; d - flagellates; g - Pyrrophyta.

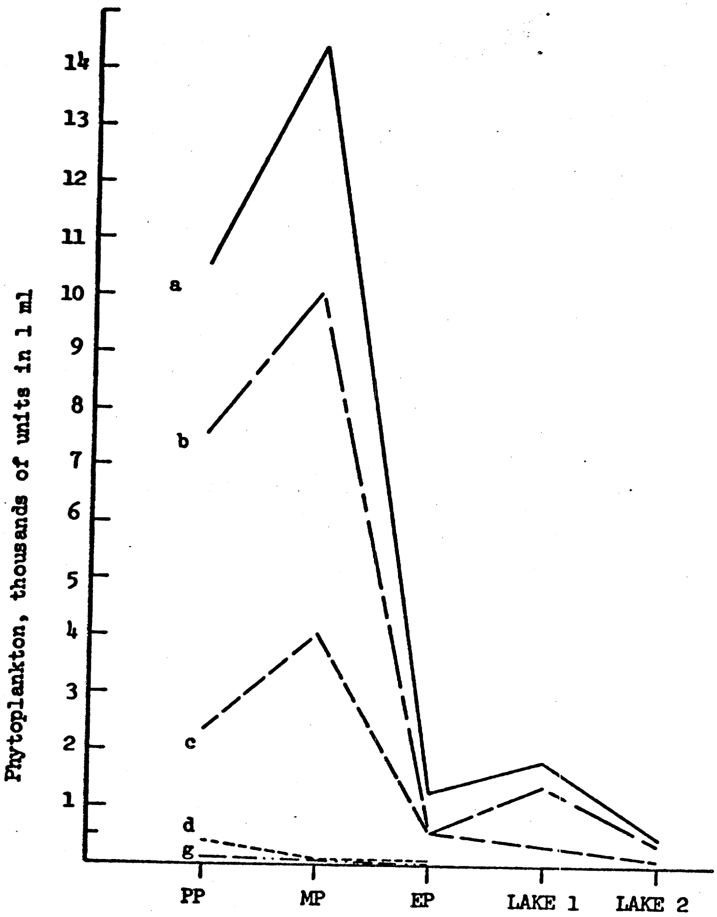

Fig. 10b Bottom phytoplankton counts. August 29, 1969. a - total algae; b - diatoms; c - greens; d - flagellates; g - Pyrrophyta.

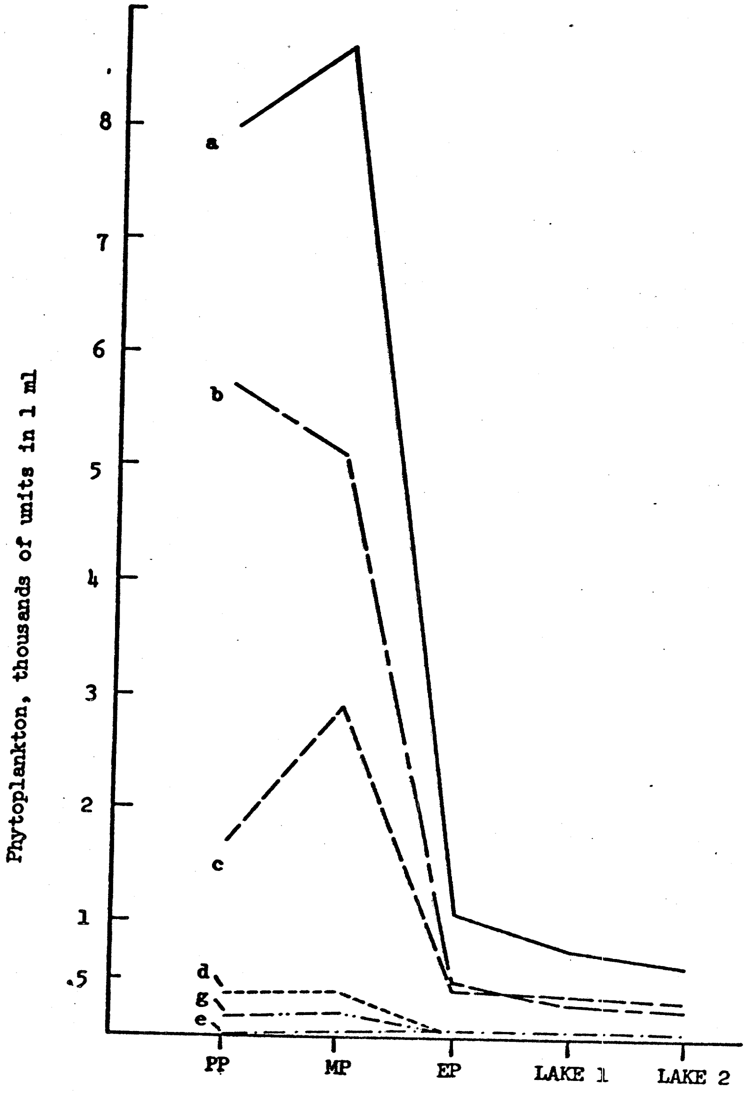

Fig. 10c Average phytoplankton counts. August 29, 1969. a - total algae; b - diatoms; c - greens; d - flagellates; e - blue greens; g - Pyrrophyta.

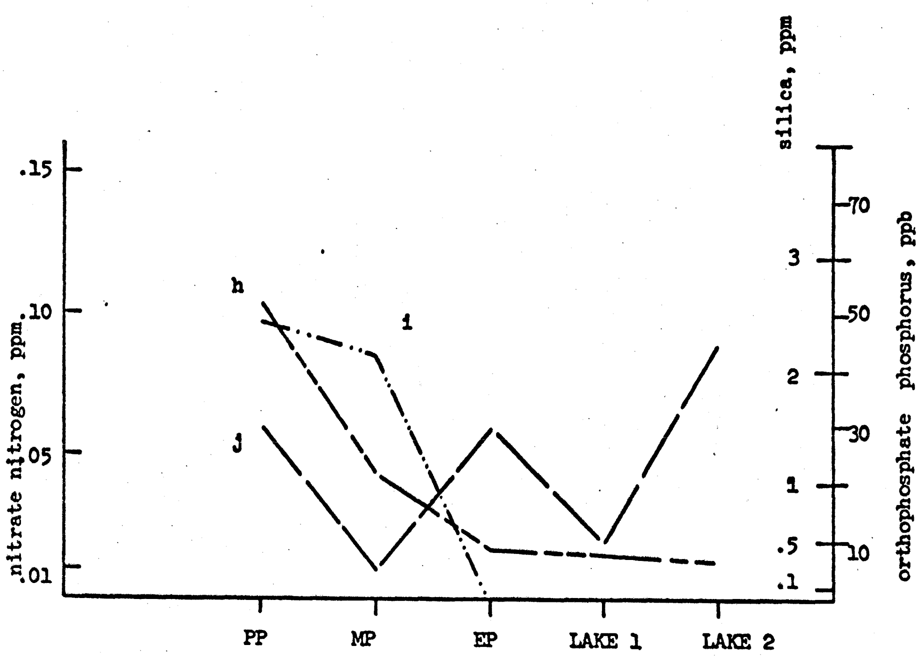

Fig. 10d Surface concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. August 29, 1969.

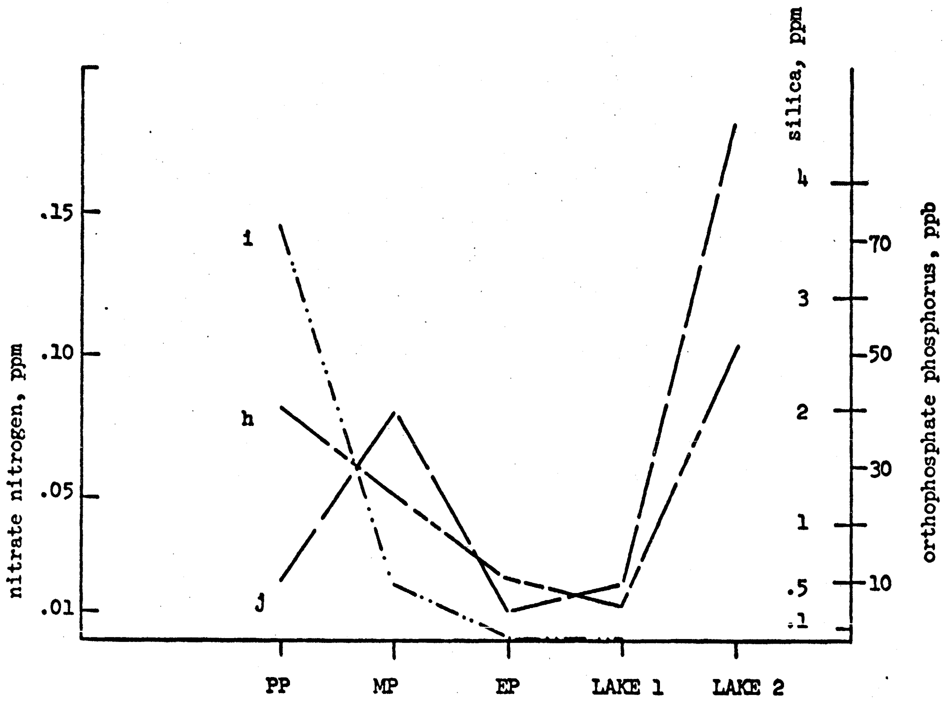

Fig. 10e Bottom concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. August 29, 1969.

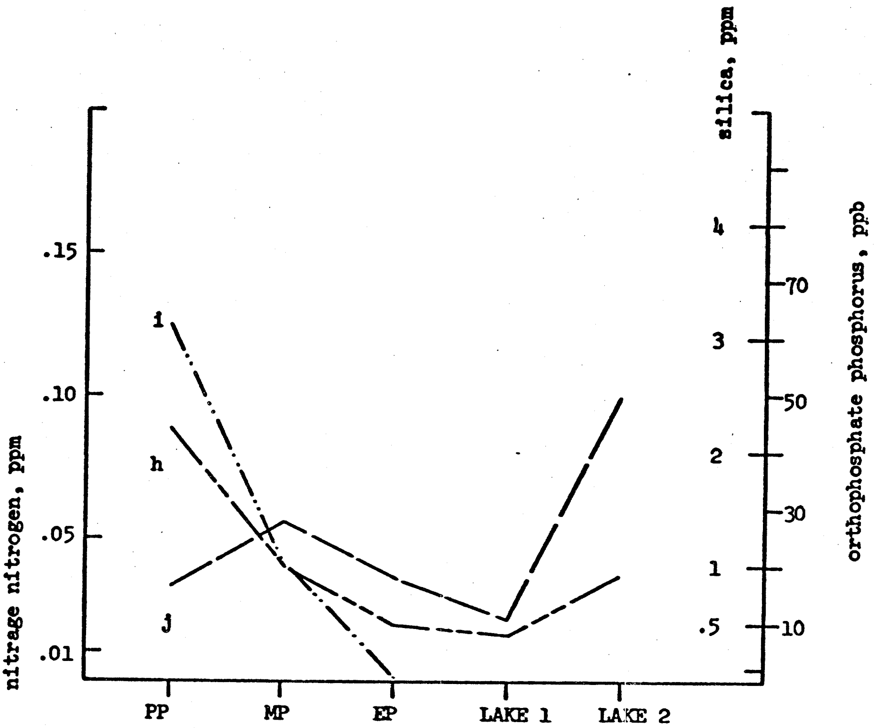

Fig. 10f Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. August 29, 1969.

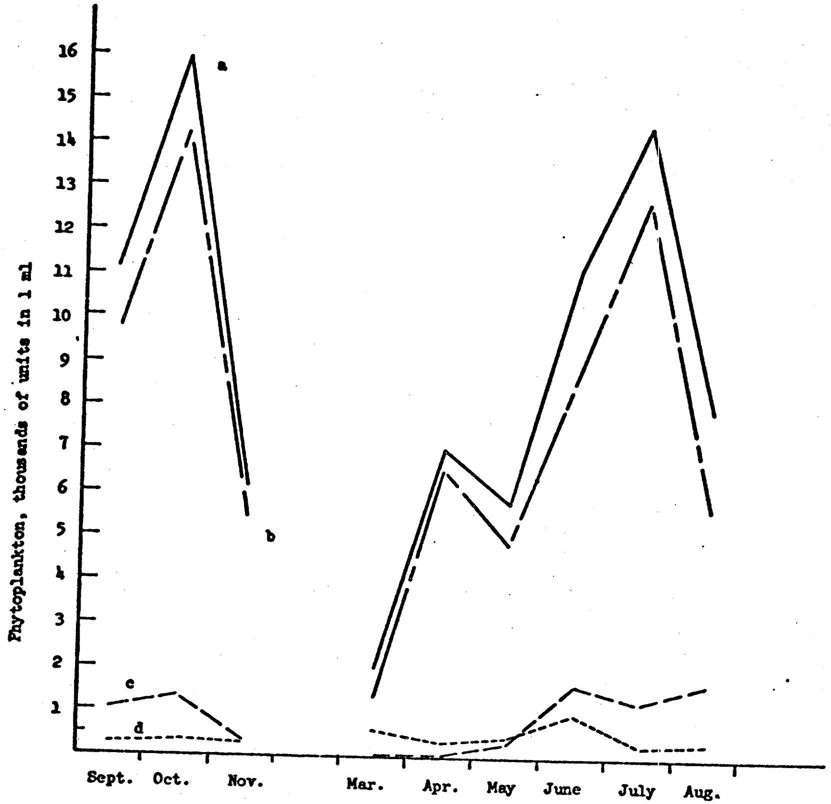

Fig. 11a Phytoplankton, average counts in the Grand River, September 1968 to August 1969. a - total algae; b - diatoms; c - greens; d - flagellates.

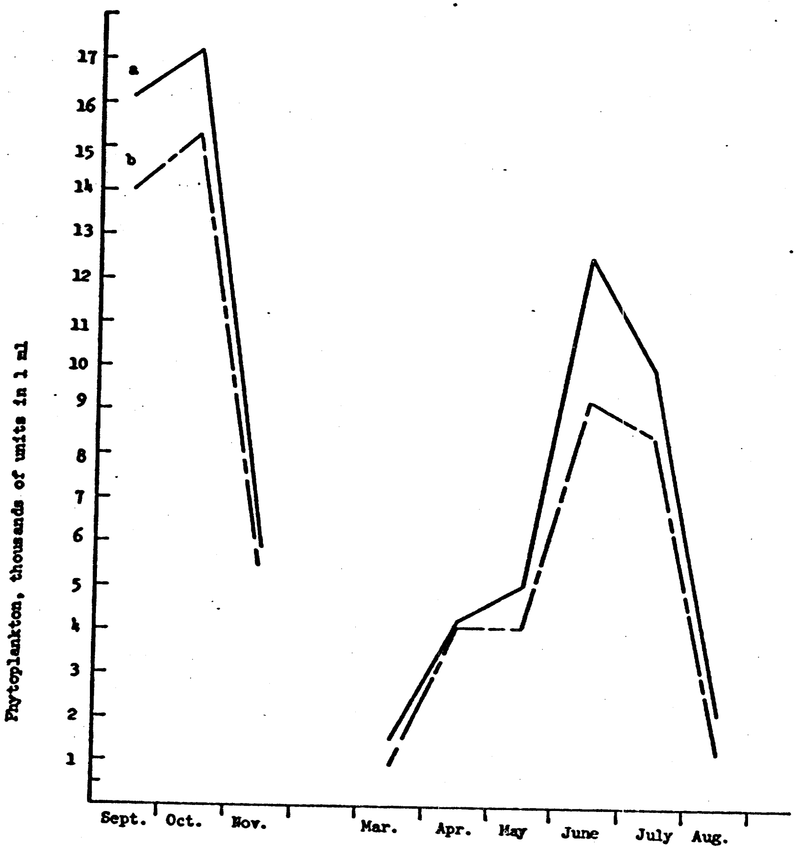

Fig. 11b Phytoplankton, surface counts in the Grand River, September 1968 to August 1969. a - total algae; b - diatoms.

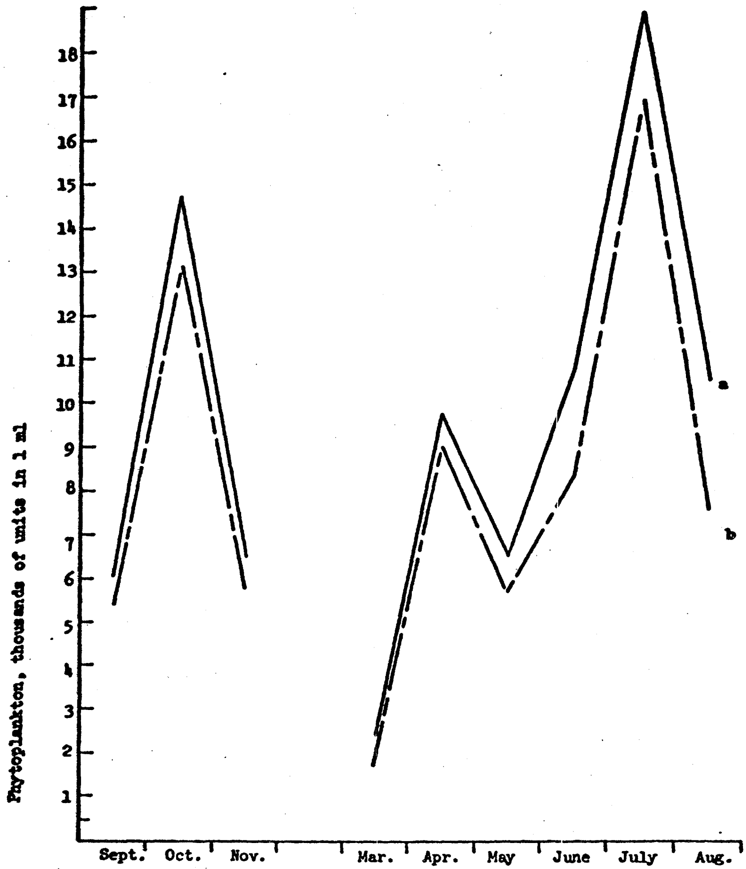

Fig. 11c Phytoplankton, bottom counts in the Grand River, September 1968 to August 1969. a - total algae; b - diatoms.

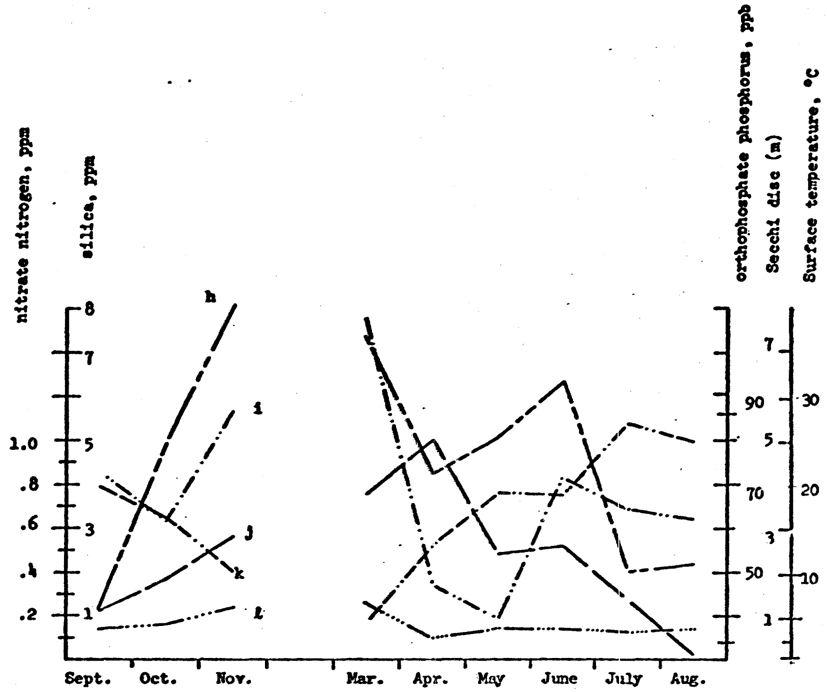

Fig. 11d Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Values of: k - surface water temperature; *l* - Secchi disc. Grand River, September 1968 to August 1969.

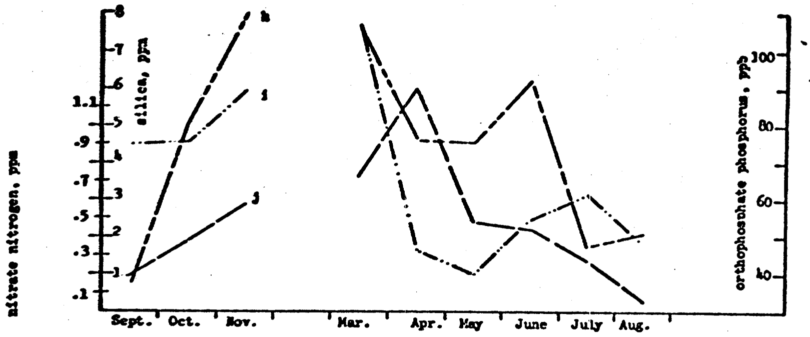

Fig. 11e Surface concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Grand River; September 1968 to August 1969.

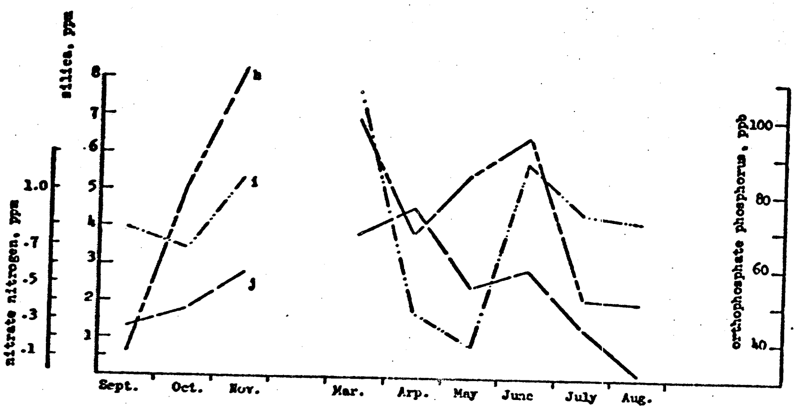

Fig. 11f Bottom concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Grand River, September 1968 to August 1969.

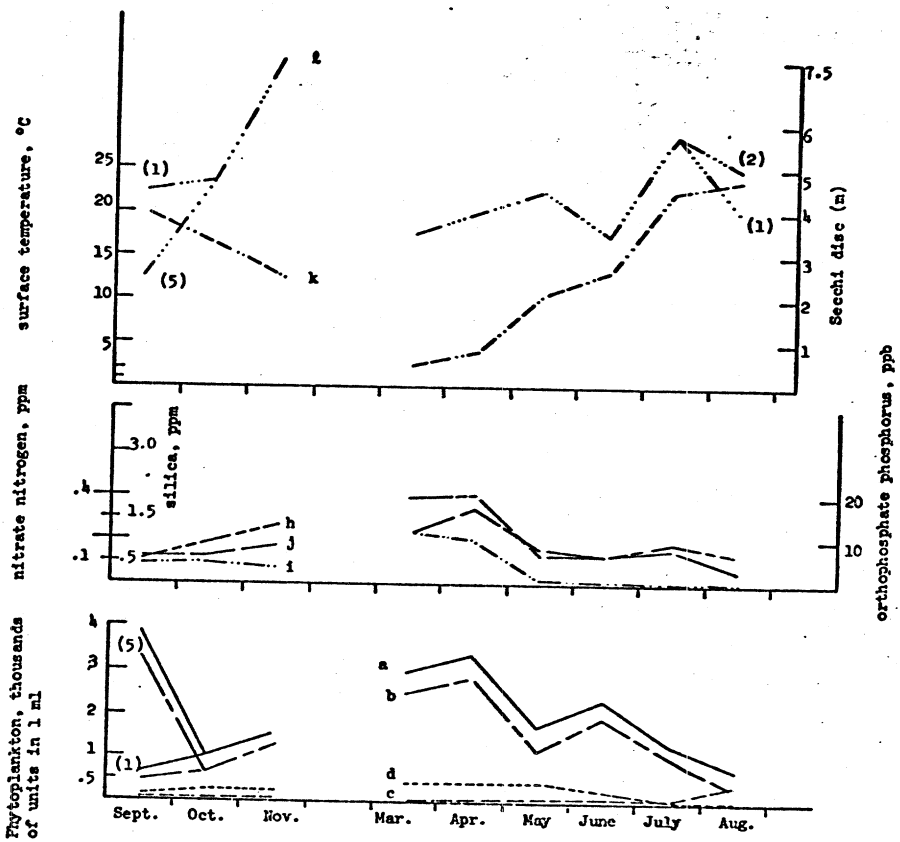

Fig. 12a (upper). Values of: k - surface water temperature; *l* - Secchi disc. Fig. 12b (middle). Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 12c (lower). Phytoplankton, average counts: a - total algae; b - diatoms; c - greens; d - flagellates. Inshore lake stations, September 1968 to August 1969.

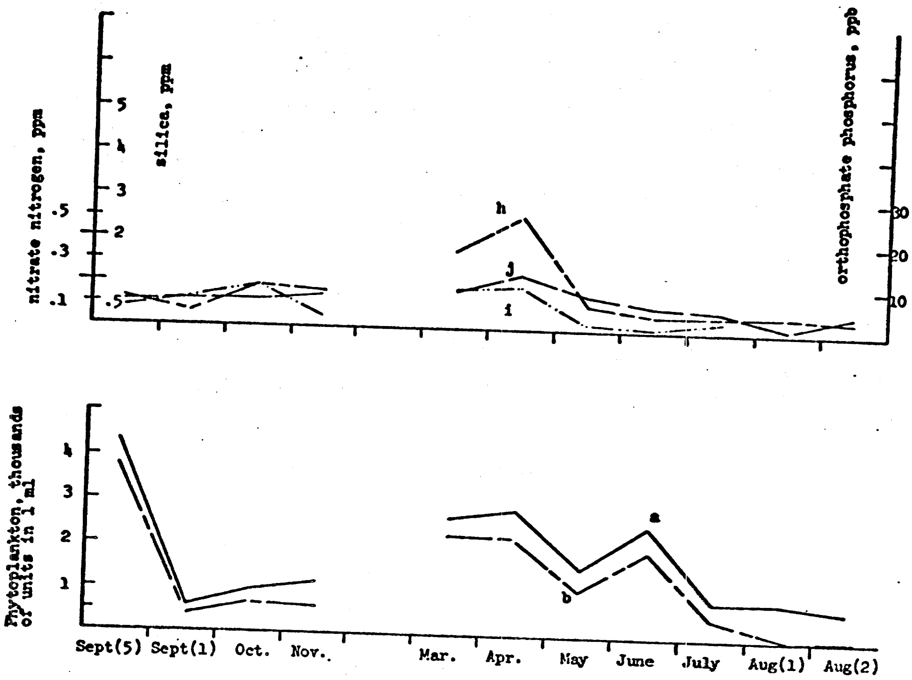

Fig. 12d (upper). Surface concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 12e (lower) Phytoplankton; surface counts; a - total algae; b - diatoms. Inshore lake stations, September 1968 to August 1969.

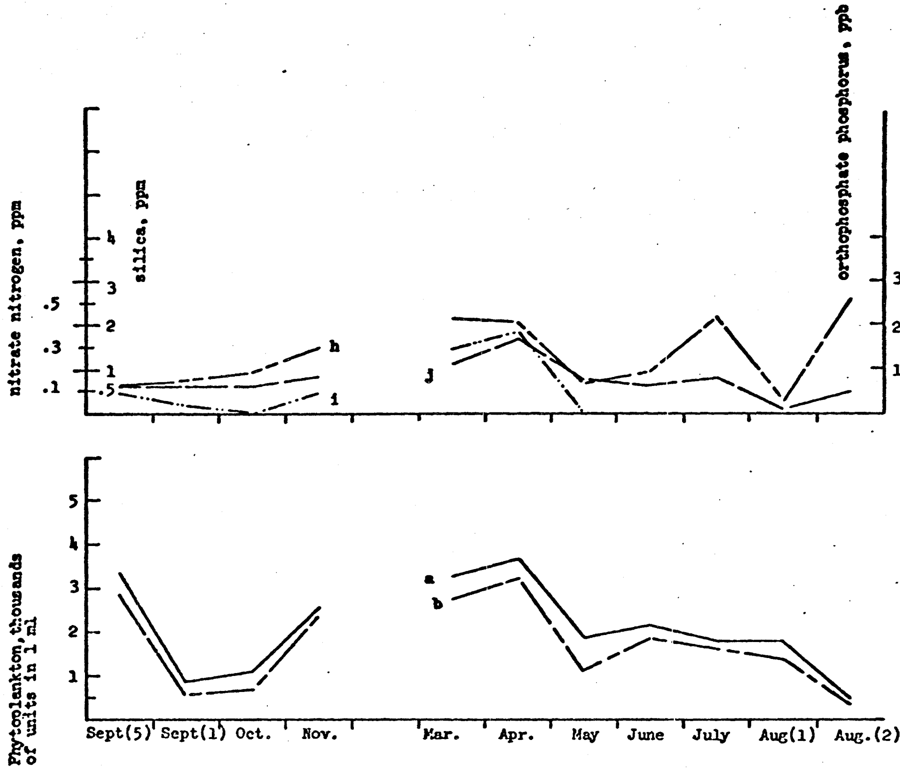

Fig. 12f (upper). Bottom concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 12g (lower). Phytoplankton, bottom counts: a - total algae; b - diatoms. Inshore lake stations, September 1968 to August 1969.

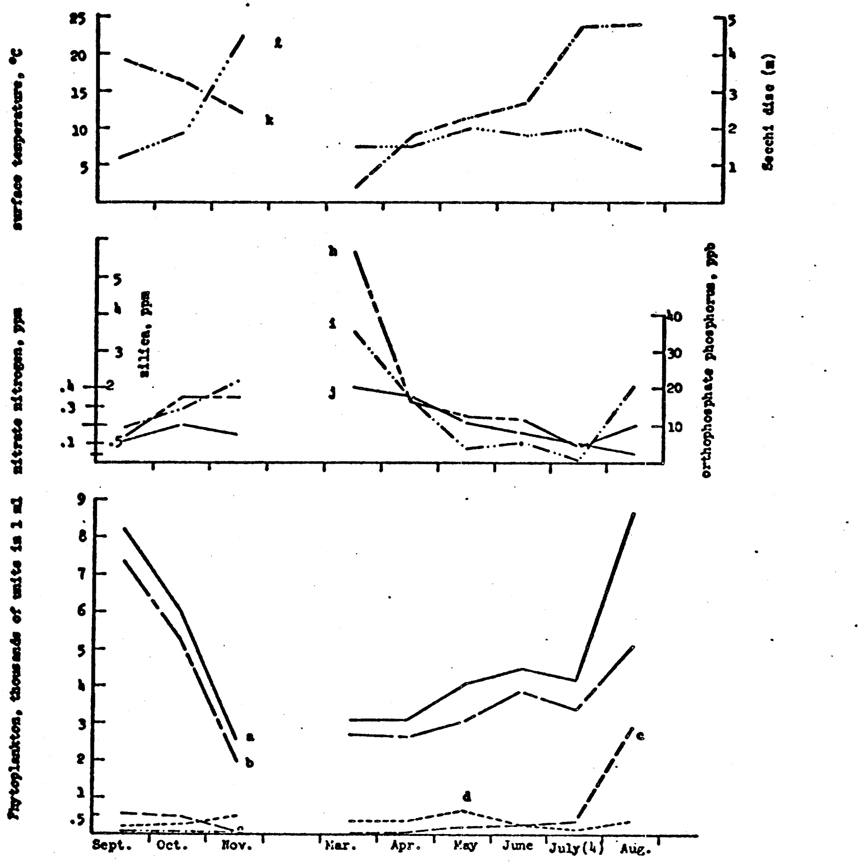

Fig. 13a (upper). Values of: k - surface water temperature; *l* - Secchi disc. Fig. 13b (middle). Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 13c (lower). Phytoplankton, average counts: a - total algae; b - diatoms; c - greens; d - flagellates; e - blue greens. Middle of the river plume, September 1968 to August 1969.

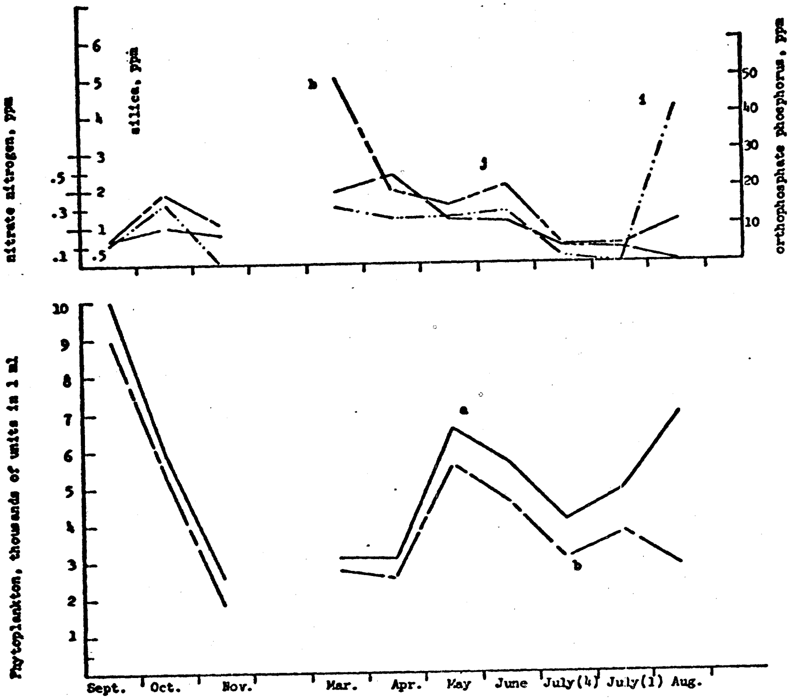

Fig. 13d (upper). Surface concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 13e (lower). Phytoplankton, surface counts: a - total algae; b - diatoms. Middle of the river plume, September 1968 to August 1969.

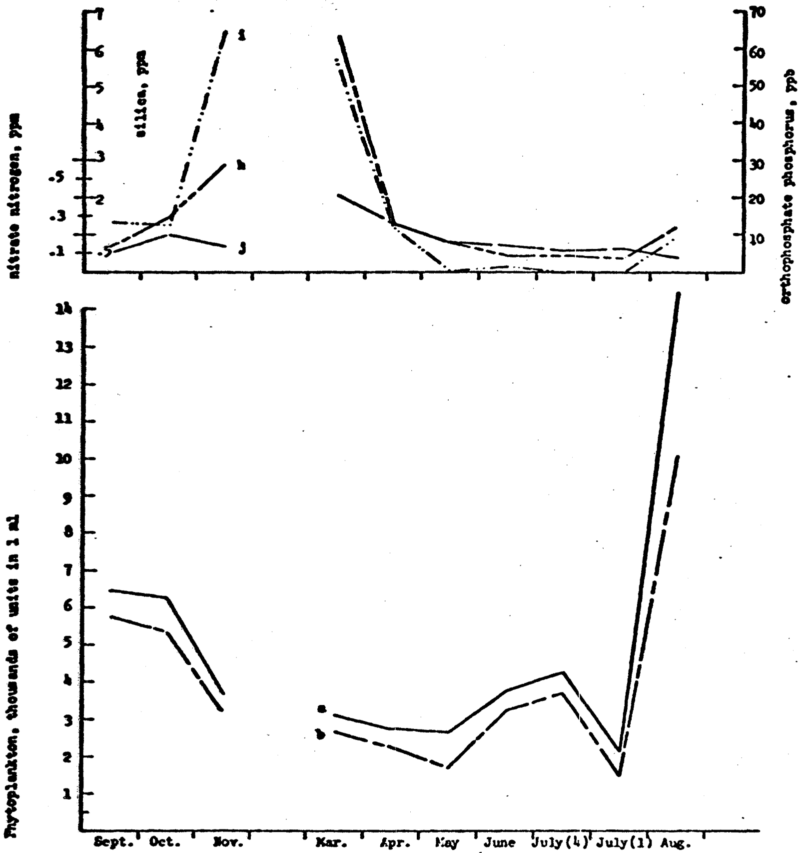

Fig. 13f (upper). Bottom concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 13g (lower). Phytoplankton, bottom counts: a - total algae; b - diatoms. Middle of the river plume, September 1968 to August 1969.

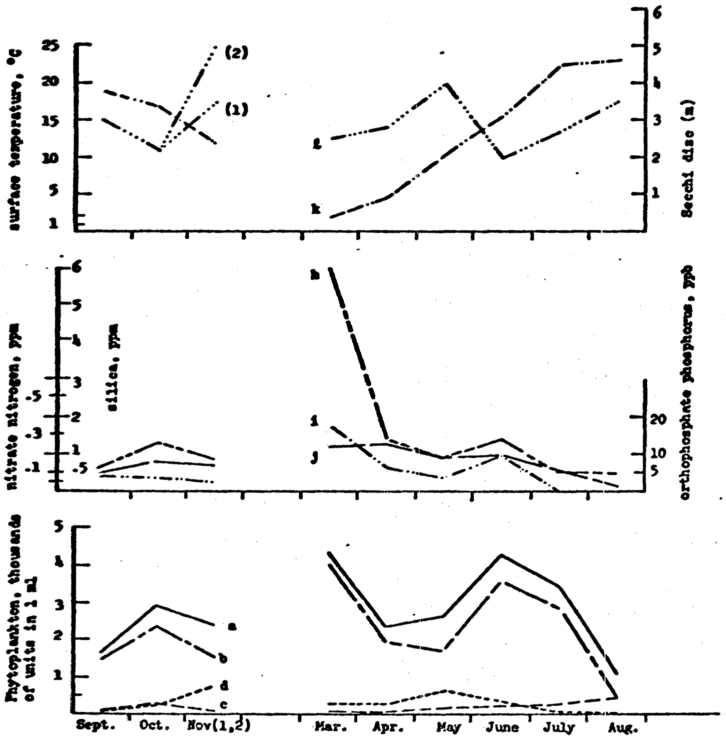

Fig. 14a (upper). Values of: k - surface water temperature; *l* - Secchi disc. Fig. 14b (middle). Average concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 14c (lower). Phytoplankton, average counts: a - total algae; b - diatoms; c - greens; d - flagellates. Edge of the river plume, September 1968 to August 1969.

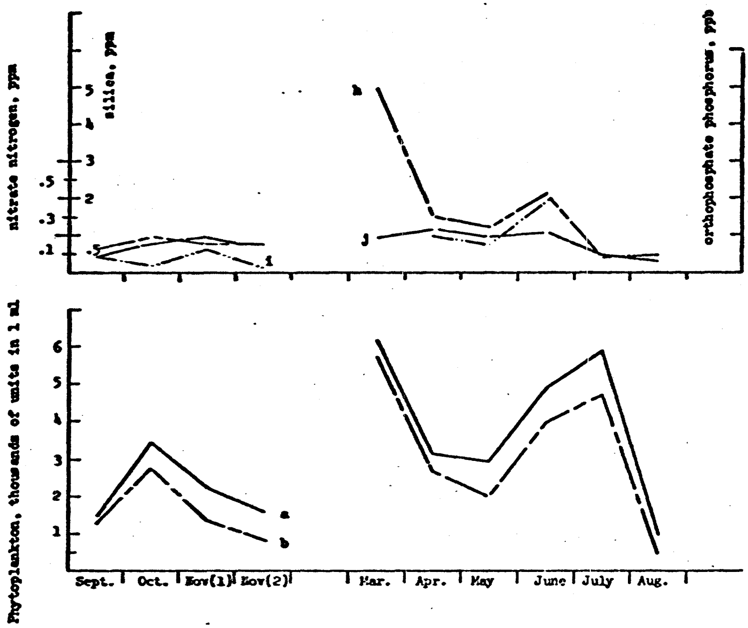

Fig. 14d (upper). Surface concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 14e (lower). Phytoplankton, surface counts: a - total algae; b - diatoms. Edge of the river plume, September 1968 to August 1969.

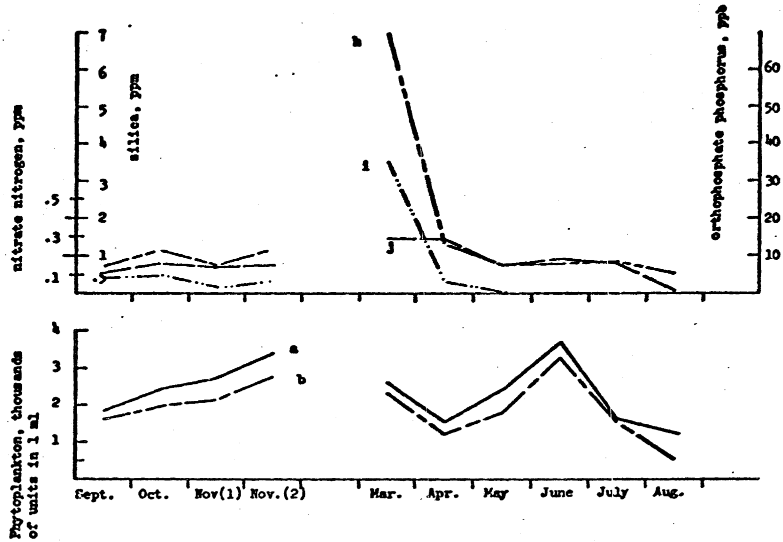

Fig. 14f (upper). Bottom concentrations of: h - silica; i - orthophosphate; j - nitrate nitrogen. Fig. 14g (lower). Phytoplankton, bottom counts: a - total algae; b - diatoms. Edge of the river plume, September 1968 to August 1969.

Table 1. Dominant Species and Genera of Diatoms Found in the River and Lake Survey Stations. Estimated Numbers of cells in 1 ml of Sample.

STATION	Power Plant																		
MONTH	Sept.		Oct.		Nov.		Mar.		Apr.		May		June		July		August		
DEPTH, METERS	1	6.6	1	7.5	1	6.6	1	6.6	1	6.6	1	6.6	1	8	1	8	1	6	8
TOTAL DIATOMS	14018	5395	15269	13191	5353	5629	910	1728	4108	9037	4073	5658	9274	8341	8496	16941	1226	8334	7556
TOTAL CENTRALES	13472	5166	14265	12513	5094	5222	602	1328	3483	7672	3445	4462	8034	6437	7651	14419	1083	7250	6501
Cyclotella comta (Ehr.) Kütz.						32	4		7		105	49	69	24	17		3		
C. comensis Grun.																			
C. cryptica Reimann, Lewin & Guillard																	61	610	264
C. kützingiana Thw.	27																13	433	122
C. meneghiniana Kütz.					10		4			110	35	20	48	12		45	5		
C. meneghiniana v. *plana* Fricke					248	294	112	48	492	714	468	889	305	273	142	203	32	555	352
	7970	2968	7926	8628	3146	3171	281	361	985	1270	1338	790	3077	1852	5018	8935	530	2255	2625
C. michiganiana Skv.	27	55				32	4	4	50										
C. ocellata Pant.	55	45			10														
C. operculata (Agardh) Kütz.																	2		9
C. pseudostelligera Hust.																			29
C. stelligera (Cleve & Grun.) V.H.																		8	9
C. striata (Kütz.) Grun.	137	30	111	237				4			10	30		12	17		2	9	9
																	23	15	101
Coscinodiscus subsalsa Juhl.-Dannf.	55	23	94	50	68	16	4		7	26	15		48	12					
Coscinodiscus sp.																		9	35
																	12	67	35
Melosira granulata (Ehr.) Ralfs	1456	323	1339	530	463	473	8	28	122	185	51	145	704	828	645	1246	255	2259	1575
M. granulata v. *angustissima* O. Müll.	3032	1130	3465	2088	561	597	22	67	9	75	149	254	3041	2595	1113	2700	103	745	1172
M. granulata fo. *spiralis* Grun.																			
M. islandica O. Müll.																			
M. italica subsp. *subarctica* O. Müll.											3				177	229			
M. varians Ag.			15	32	28	16	4	15	7	58		111	141	130	20	73	7	37	30

Table 1 (cont.)

STATION	Power Plant																		
MONTH	Sept.		Oct.		Nov.		Mar.		Apr.		May		June		July		August		
DEPTH, METERS	1	6.6	1	7.5	1	6.6	.1	6.6	1	6.6	1	6.6	1	8	1	8	1	6	8
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	55		40		28	16		10			38	49			249	493			9
S. astrea (Ehr.) Grun.	27	8	280	217	10	48		4		76	38	30	196	99	17	40	3		9
S. binderanus (Kütz.) Krieg.																			
S. hantzschii Grun.	55	8	17	46	20	32			1415	3547	480	161	48	236	34	35		35	9
S. minutus Grun. ex Cleve & Möll.							50	55	252	1297	208	110	130	74	17	40	3	15	
S. subtilis (Van Goor) A.Cl.	440	185	561	404	179	195	20	431	7	100	258	1334	196	186	159	284	17	115	94
S. tenuis Hust. ex Huber-Pestalozzi	110	382	411	268	317	294	84	292	126	212	229	481	27	87	17	45	7	74	
S. transilvanicus Pant.																			
TOTAL PENNALES	546	229	1004	678	259	407	308	400	625	1365	628	1196	1240	1904	845	2522	143	1084	1055
Genus *Asterionella* Hass.		2	80	140	7	4	27	37	13	148	195	344	214	181				7	59
Genus *Diatoma* Bory	14		17		5	2	6	7	11	53	12	37	7	56	5	22	5	7	10
Genus *Fragilaria* Lyngb.	114	79	197	55	67	54	55	29	32	47	114	95	118	713	396	1246	37	322	364
F. capucina Desm.			20	1			10	7		5	20	15	4	18	20		1	20	9
F. crotonensis Kitt.	25	65	5	25	1	19			11	3	10	9	59	320	170	704	7	159	239
Genus *Navicula* Bory	85	13	170	103	96	111	80	78	289	430	137	185	304	275	37	250	18	144	66
Genus *Nitzschia* Hass.	103	68	206	159	37	94	57	78	42	193	61	190	199	246	185	282	43	309	219
Genus *Synedra* Ehr.	82	44	192	129	32	22	10	29	85	218	63	237	95	113	111	289	3	142	33
Genus *Tabellaria* Ehr.	1	1	1		2	2	4	2		2						37	0.5	0.2	0.1
T. fenestrata (Lyngb.) Kütz.	1	1	1		2	2	4	2		2						37	0.5	0.2	0.1
TOTAL PHYTOPLANKTON	16163	6051	17195	14720	5895	6496	1535	2429	4275	9776	5058	6524	12619	10758	9996	18939	2138	11325	10524

Table 1 (cont.)

STATION	Middle Plume																								
MONTH	Sept.		Oct.		Nov.			Mar.		Apr.			May			June			Jul(4)		Jul(1)		Aug.		
DEPTH, METERS	1	6	1	7	1	7	9	1	7.5	1	6	14.5	1	5	13	1	5	11	1	14	1	15	1	5	9
TOTAL DIATOMS	8960	5764	5205	5339	1832	895	3263	2773	2646	2566	3089	2256	5611	1796	1738	4596	3758	3275	3082	3722	3785	1505	2844	2381	10095
TOTAL CENTRALES	8324	5416	4048	4051	696	406	2173	1796	1791	1806	1993	1204	4125	1258	820	3070	2218	1443	2631	2607	3187	571	8495	2141	8456
Cyclotella comta (Ehr.) Kütz.	18	5	43	36	20	66	45	12	11	15	26	21	9	5	2	6	9		23	22	46	32	13	9	32
C. comensis Grun.																							71	122	615
C. cryptica Reimann, Lewin & Guillard								5															39	79	266
C. kützingiana Thw.	18	5	27	22	62	41	129	5	5	20	30	18		15		6	3	4	28	14	34	10	2	2	
C. meneghiniana Kütz.	167	65	5	6			57	5	70	187	159	36	292	48	2	50	20		32	82	26	2	102	41	477
C. meneghiniana v. *plana* Fricke	3439	2287	2008	1835	36	10	797	70	49	591	616	166	378	281	60	531	295	32	1488	1046	1070	91	519	471	2919
C. michiganiana Skv.	148	23	142	237	61	21	106	12	49	5	15	3				9	3								
C. ocellata Pant.	9		11	21	10	3	12	87	70	30	29	57	8	21	9	10	17	2	23	35	57	54	2		14
C. operculata (Agardh) Kütz.																			150	98	154	139	21	27	41
C. pseudostelligera Hust.													154	10			3		4	8	8		3	5	
C. stelligera (Cleve & Grun.) V.H.	27	11	54	42	13		12	377	275		15	3	86	5	6	25	3		28	45	38	12		9	
C. striata (Kütz.) Grun.																									
Coscinodiscus subsalsa Juhl.-Dannf.	18	17	27	10		3	38			15	30						7	4	10	5			2	2	41
Coscinodiscus sp.																							5	17	82
Melosira granulata (Ehr.) Ralfs	803	913	272	411	192	132	485	5	6	62	35	33	85	120	115	547	200	134	169	278	203	105	1150	1109	2922
M. granulata v. *angustissima* O. Müll.	3378	1950	1177	1068	198	32	107	5	6	9	17	4	151	93	83	1376	924	727	582	799	1240	51	546	215	945
M. granulata fo. *spiralis* Grun.													258								74	24			
M. islandica O. Müll.								162	150	64	87	155	8	26	28	98	158	85			29	18			
M. italica subsp. *subarctica* O. Müll.								51	46	27	35	66	13	20	21						27				
M. varians Ag.	1		11	15					7	9	17	5	140	17	4	26	19	21		3	3			2	

Table 1 (cont.)

STATION	Middle Plume																								
MONTH	Sept.		Oct.		Nov.			Mar.		Apr.			May			June			Jul(4)		Jul(1)		Aug.		
DEPTH, METERS	1	6	1	7	1	7	9	1	7.5	1	6	14.5	1	5	13	1	5	11	1	14	1	15	1	5	9
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	18	46	87	121	56	23	152	546	656	182	220	314	16	92	74	85	176	178	50	55	119	20	6	7	41
S. astrea (Ehr.) Grun.	9		43	30	15	2	6	5	49	15	12	18	8	21	6	15	17	5				1	2		14
S. binderanus (Kütz.) Krieg.													593	24	185	58	178	146	11	69					
S. hantzschii Grun.	18	25	5		2	1	38		11	293	441	90	663	346	99	101	91	82			8		3	8	23
S. minutus Grun. ex Cleve & Möll.								131	155	151	45	50	24	15	77	31	15	5	5	5	8		3		32
S. subtilis (Van Goor) A.Cl.	203	46	43	78	3	1	45	16	28	40	53	9	611	30	9	63	26	2	23	23	26	2		8	
S. tenuis Hust. ex Huber-Pestalozzi	18	11	65	109	8	1	99	16		5	30	9	516	20	35	60	17	10		8	4	1	2	2	23
S. transilvanicus Pant.					9		5	284	141	50	60	115	42	43	2	3	5	4			4	1			
TOTAL PENNALES	636	348	1175	1288	1136	489	1090	977	855	760	1096	1052	1486	538	918	1526	1540	1832	451	1115	598	934	349	240	1607
Genus *Asterionella* Hass.	5	12	157	44	90	51	26	84	88	38	27	26	134	60	18	68	70	46	14	35		61	9	0.1	0.1
Genus *Diatoma* Bory	1	1	56	50	48	4	54	38	46	8	23	26	81	10	60	213	252	356	14	38	23	25	0.1	0.1	27
Genus *Fragilaria* Lyngb.	226	83	643	879	875	401	897	231	146	144	441	429	297	135	213	522	570	672	220	688	356	263	197	70	412
F. capucina Desm.			246	220	87	86	123	15	2	10	42	38	113	33	50	209	320	354	10	426	22	30	1	15	49
F. crotonensis Kitt.	190	70	343	628	783	311	728	203	135	116	338	359	105	66	128	291	172	259	191	260	315	206	146	42	144
Genus *Navicula* Bory	123	63	46	32	6	4	24	18	65	136	85	37	151	21	22	54	41	22	11	8	6	1	6	3	194
Genus *Nitzschia* Hass.	139	92	120	99	60	38	24	150	168	61	37	85	243	109	102	83	68	45	66	72	59	17	15	111	295
Genus *Synedra* Ehr.	50	34	66	45	19	4	21	276	209	157	192	187	268	84	166	95	93	82	43	50	46	5	84	18	230
Genus *Tabellaria* Ehr.	9	7	14	74	29	34	14	144	52	150	204	256	205	104	296	385	368	593	70	183	96	554	6	9	64
T. fenestrata (Lyngb.) Kütz.	9	7	14	74	29	16	14	144	52	150	204	256	205	100	289	369	328	580	70	183	96	530	6	9	55
TOTAL PHYTOPLANKTON	10010	6461	5873	6286	2564	1439	3731	3110	3091	3070	3513	2753	6587	2859	2667	5669	4043	3779	4114	4271	4917	2133	6967	4693	14433

Table 1 (cont.)

STATION	Edge of Plume																								
MONTH	Sept.		Oct.		Nov(1)			Nov.(2)			Mar.		Apr.		May			June		July			August		
DEPTH, METERS	1	6.6	1	6.6	1	5	9	1	5	9	1	14.2	1	15.7	1	5	16	1	16	1	8	15	1	5.5	7
TOTAL DIATOMS	1281	1617	2794	1954	1355	1339	2155	837	1165	2723	5754	2327	2705	1218	2016	1369	1803	3953	3257	4732	2430	1531	436	520	536
TOTAL CENTRALES	1157	1401	1989	1384	514	318	344	307	388	1357	4586	1547	1525	591	1258	693	963	2870	1651	4029	1002	123	217	258	461
Cyclotella comta (Ehr.)Kütz.	9	12	20	17	32	12	21	27	41	133		6	2		19			7	4	37	26	3	10	12	23
C. comensis Grun.																							0.2	0.1	11
C. cryptica Reimann, Lewin & Guillard						1					5												0.2	0.1	6
C. kützingiana Thw.	10	4	27	14	44	41	60	48	89	104	20	12	2	6		19	12	2	4	28	6	0.2	0.2		1
C. meneghiniana Kütz.			20			1				10	20	14	54	13	15	2	4	41	3	113	37	1	0.2	3	16
C. meneghiniana v. *plana* Fricke	490	432	826	605	20	27	24	14	9	235	46	20	63	50	350	137	40	397	34	1584	257	28	44	46	137
C. michiganiana Skv.	63	85	106	112	57	56	98	46	24	71	23	42						4	3						
C. ocellata Pant.			12	15		5	6	5		16	380	108	21	26	15	15	16	2	7	51	33	8	0.2	0.1	1
C. operculata (Agardh) Kütz.																				348	145	16	1	2	18
C. pseudostelligera Hust.						1									4	2	3	4	3	32	3		0.2	0.1	
C. stelligera (Cleve & Grun.) V.H.	3	25	20	18	5	9	9	11	4		475	308	57	6						65	13	1		0.1	1
C. striata (Kütz.) Grun.																									
Coscinodiscus subsalsa Juhl.-Dannf.	3	2	27	15		1	5			25				2				2			14	2	1	1	1
Coscinodiscus sp.						1																	0.2	0.1	
Melosira granulata (Ehr.) Ralfs	125	211	320	114	144	68	13	50	74	193	4	4	1	2	70	18	90	501	287	137	122	9	146	160	182
M. granulata v. *angustissima* O. Müll.	395	589	485	372	178	72	27	73	110	451	4	4	2	3	35	17	41	1301	594	1199	240	15	11	25	29
M. granulata fo. *spiralis* Grun.															6		32			88					
M. islandica O. Müll.											267	260	235	102	20	18	28	146	50	84	22	17			
M. italica subsp. *subarctica* O. Müll.											77	57	110	43	18	14	27	140	83						
M. varians Ag.	1		12	4						6		5	2		18	6	4	33	26	5	3	0.5	0.2		11

Table 1 (Con.t)

STATION											Edge of Plume														
MONTH	Sept.		Oct.		Nov(1)			Nov.(2)			Mar.		Apr.		May			June		July			August		
DEPTH, METERS	1	6.6	1	6.6	1	5	9	1	5	9	1	14.2	1	15.7	1	5	16	1	16	1	8	15	1	5.5	7
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	15	4	58	29	12	25	45	16	19	52	2116	502	133	157	94	50	124	53	151	122	33	15	2	3	11
S. astraea (Ehr.) Grun.	5	2	15	7		11	13	3	5	6	20	6		3	19	8	6	4	2			0.5			1
S. binderanus (Kütz.) Krieg.											15				39	90	258	87	262	22	1				
S. hantzschii Grun.	1			6	4	8	2	3	2	14			322	33	401	203	172	77	83	5	2	0.2		0.1	1
S. minutus Grun. ex Cleve & Möll.						3					166	24	188	50	59	34	32	12	10		1	0.2	0.2	0.1	1
S. subtilis (Van Goor)A.Cl.	31	30	20	36	4	3	3			14	23			2	19	27	8	25	7	56	10	0.2			1
S. tenuis Hust. ex Huber-Pestalozzi	4	2	12	11	4	24	8	5	2	14		6	222	6	19	12	14	23	34	28	7				
S. transilvanicus Pant.					4	1	3		2	6	903	163	70	78	10	10	16	4	2		3	2	0.2		1
TOTAL PENNALES	124	216	805	570	841	1021	1811	530	777	1366	1168	780	1180	627	758	676	840	1083	1606	703	1428	1408	219	262	75
Genus *Asterionella* Hass.	9	7	21	35	39	56	149	50	50	87	127	49	55	7	96	25	28	7	31	13	77	25	2	3	0.2
Genus *Diatoma* Bory	4	1	19	12	44	97	113	17	30	74	42	26	70	1.6	26	52	83	186	244	33	31	2	1	2	2
Genus *Fragilaria* Lyngb.	3	92	554	374	675	764	1426	419	576	1102	560	268	453	331	219	147	139	531	767	330	576	408	113	184	33
F. capucina Desm.			90	52	59	168	386	21	80	120	72	34	40	37	85	60	32	217	309	140	131	161	30	45	8
F. crotonensis Kitt.	0.6	71	395	285	616	602	1034	397	495	901	312	202	368	256	113	64	87	281	390	180	434	241	40	62	13
Genus *Navicula* Bory	36	38	22	18	4	1	1	2	0.1	12	15	44	3	14	13	11	3	33	13	9	11	5	10	11	6
Genus *Nitzschia* Hass.	41	40	101	79	35	2'	65	6	8	21	176	125	50	32	80	85	95	19	62	184	59	17	26	12	13
Genus *Synedra* Ehr.	4	9	22	20	6	8	3	12	11	2	116	157	322	109	135	147	190	79	109	63	8	3	10	5	7
Genus *Tabellaria* Ehr.	2	6	28	6	16	51	44	16	72	33	124	75	218	115	168	200	285	198	350	63	658	940	5	11	1
T. fenestrata (Lyngb.) Kütz.	2	6	28	6	16	51	44	16	72	33	124	75	218	115	168	200	285	198	350	63	658	940	5	11	1
TOTAL PHYTOPLANKTON	1479	1841	3447	2418	2224	2317	2711	1604	2324	3394	6180	2612	3143	1562	2924	2496	2411	4901	3704	5887	2897	1616	944	1045	1224

Table 1 (cont.)

STATION										Lake									
MONTH	Sept(5)		Sept(1)			Oct.		Nov.				Mar.		April			May		
DEPTH, METERS	1	8	1	10	17	1	9	1	10	25	28	1	19	1	14	25	1	10	25
TOTAL DIATOMS	3801	2837	395	343	589	659	689	610	335	1569	2397	2249	2734	2227	3027	3207	1073	1369	1118
TOTAL CENTRALES	3418	2590	325	317	476	254	294	171	113	583	924	1781	2094	1180	1954	2237	441	656	261
Cyclotella comta (Ehr.) Kütz.	4	7	3		2	7	4	9	14	59	10	10	35		4	3	1	2	2
C. comensis Grun.																			
C. cryptica Reimann, Lewin & Guillard																			
C. Kützingiana Thw.	23	7	6	11	2	15	3	22	25	72	65			7	25		1	7	3
C. meneghiniana Kütz.								1		3	27	20	46	14	17	94	1	4	1
C. meneghiniana v. *plana* Fricke																			
C. michiganiana Skv.	1395	1084	72	78	59	23	49	45	28	66	95			62	17	39	12	30	36
C. ocellata Pant.	158	100	34	17	48	41	43	19	5	77	44			20			1		
C. operculata (Agardh) Kütz.			3		8	1				23	6	139	177	69	77	50	9	31	4
C. pseudostelligera Hust.																			
C. stelligera (Cleve & Grun.) V.H.										3							20		2
C. striata (Kütz.) Grun.	35	1	16	1	21	3	5	10	1	3	16	39	112	20	43	22	9	4	1
Coscinodiscus subsalsa Juhl.-Dannf.	21	4			1	1	1			3	3								
Coscinodiscus sp.																			
Melosira granulata (Ehr.) Ralfs	391	367	38	67	83	51	85	8	19	83	270	10	9	7	5	4	22	30	22
M. granulata v. *angustissima* O. Müll.	1261	962	121	136	240	86	77	38	11	86	273	16	13	6			8	9	7
M. granulata fo. *spiralis* Grun.																			
M. islandica O. Müll.																			
M. italica subsp. *subarctica* O. Müll.												330	197	213	202	460	20	28	21
M. varians Ag.	4	7							1		1	31	23	76	86	156	11	29	13

Table 1 (cont.)

STATION	Lake																		
MONTH	Sept(5)		Sept(1)			Oct.			Nov.			Mar.		April			May		
DEPTH, METERS	1	8	1	10	17	1	9	1	10	25	28	1	19	1	14	25	1	10	25
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	4	18	7	1	3	11	5	2	1	67	43	607	836	194	430	417	17	77	26
S. astrea (Ehr.) Grun.	14	7	5	6	2	3		5	1	5	16			7	8	22		2	1
S. binderanus (Kütz.) Krieg.																	64	72	48
S. hantzschii Grun.	14		3		1	3		1		2	6			208	473	562	93	170	26
S. minutus Grun. ex Cleve & Möll.										7		39	112	62	327	150	17	19	6
S. subtilis (Van Goor) A.Cl.	52	16	3		1			3	1	7	16	10				50	8	7	1
S. tenuis Hust. ex Huber-Pestalozzi	35	7	8		1	3	7	2	2	11	24			34	116	27	6	19	9
S. transilvanicus Pant.	4		3			1	1	1			2	517	515	173	121	172	4	25	14
TOTAL PENNALES	383	247	70	26	113	405	395	439	222	986	1473	468	640	1047	1073	970	632	713	857
Genus *Asterionella* Hass.	26	1	6	2	11	38	30	69	9	88	142	26	53	36	78	27	19	53	28
Genus *Diatoma* Bory	0.1	0.1	1.5	0.9	4	10	5	4	1	50	68	8	11	77	101	50	39	54	31
Genus *Fragilaria* Lyngb.	122	88	33	13	45	318	298	315	167	741	1149	116	220	306	304	328	166	130	237
F. capucina Desm.	1					95	102	52	12	35	181		15	5	41	48	115	35	148
F. crotonensis Kitt.	40	60	33	13	38	213	184	220	153	687	839	92	190	290	201	215	36	59	87
Genus *Navicula* Bory	48	29	0.5	0.6	1	3	7	0.5	0.1	3	4	8	11	0.1	11	28	1	8	1
Genus *Nitzschia* Hass.	85	67	6	3	16	9	24	9	2	55	52	83	108	65	60	101	35	37	28
Genus *Synedra* Ehr.	26	12	6	1	40	3	8	3	1	8	4	139	142	302	351	283	194	227	160
Genus *Tabellaria* Ehr.	13	5	25	27	4	13	13	34	37	36	37	75	87	247	146	123	155	175	342
T. fenestrata (Lyngb.) Kütz.	13	5	25	27	4	13	13	34	37	36	37	75	87	247	146	123	155	175	342
TOTAL PHYTOPLANKTON	4357	3344	597	502	861	954	1091	1146	735	1731	2554	2655	3277	2840	3483	3671	1546	1807	1869

Table 1 (cont.)

STATION	Lake												
MONTH	June		July			August(1)				August(2)			
DEPTH, METERS	1	20	1	14	31	1	5	11	16.5	1	5	18	26
TOTAL DIATOMS	1970	1851	454	994	1657	30	7	32	1352	3	2	629	388
TOTAL CENTRALES	430	609	371	283	285	7	2	15	638	2	2	277	194
Cyclotella comta (Ehr.) Kütz.	2	5	37	15	4	5	0.2	0.8	24	0.2	0.5	10	11
C. comensis Grun.													
C. cryptica Reimann, Lewin & Guillard													
C. kützingiana Thw.	1	1	5	1	2		0.2			0.2		0.1	0.1
C. meneghiniana Kütz.	1	1	6				0.1			0.2			
C. meneghiniana v. *plana* Fricke	11	28	81	4	13	1	0.2	0.7	9	0.2	0.5	5	4
C. michiganiana Skv.	4												
C. ocellata Pant.	7	5	6	36	31			0.1	1	0.2			2
C. operculata (Agardh) Kütz.			118	129	15		0.2	0.1	12	0.2	0.5	0.9	1
C. pseudostelligera Hust.	1		1										
C. stelligera (Cleve & Grun.) V.H.	2		25	15	1		0.1		1				
C. striata (Kütz.) Grun.													
Coscinodiscus subsalsa Juhl.Dannf.		1			1		0.2						
Coscinodiscus sp.												0.1	0.1
Melosira granulata (Ehr.) Ralfs	75	129	9	42	21	1	0.2	7	353	0.3	0.5	245	84
M. granulata v. *angustissima* O. Müll.	104	207	44	6	16			6	202	0.3		13	7
M. granulata fo. *spiralis* Grun.			11	16									
M. islandica O. Müll.	52	121	1	5	68		0.2	0.1	22				
M. italica subsp. *subarctica* O. Müll.	2	1			10								77
M. varians Ag.	4	13			4								

Table 1 (cont.)

STATION	Lake												
MONTH	June		July			August(1)				August(2)			
DEPTH, METERS	1	20	1	14	31	1	5	11	16.5	1	5	18	26
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	50	109	8	5	62		0.2	0.1	5	0.2		0.5	2
S. astrea (Ehr.) Grun.	2	8		1	1				1			0.1	
S. binderanus (Kütz.) Krieg.	44	8	9		3								
S. hantzschii Grun.	32	14			7								0.1
S. minutus Grun. ex Cleve & Möll.		4	1		1			0.1	1				0.1
S. subtilis (Van Goor) A.Cl.				1	1								
S. tenuis Hust. ex Huber-Pestalozzi	17	2											0.1
S. transilvanicus Pant.	3	22	1	2	15		0.2		1				0.1
TOTAL PENNALES	1548	1162	83	711	1372	23	5	17	714	1		352	194
Genus *Asterionella* Hass.	36	22	6	45	8				11			31	
Genus *Diatoma* Bory	323	85	3	2	8				8			1	
Genus *Fragilaria* Lyngb.	590	470	51	305	459	21	2	15	598			233	63
F. capucina Desm.	285	237	8	13	118	5	1		68			51	29
F. crotonensis Kitt.	291	205	42	291	301	15	1	13	500			179	33
Genus *Navicula* Bory	2	8	1	2	7				3				
Genus *Nitzschia* Hass.	26	29	7	2	15				47			32	4
Genus *Synedra* Ehr.	148	92	3	2	24				2				2
Genus *Tabellaria* Ehr.	406	420	10	345	830		3	1	40	1		42	113
T. fenestrata (Lyngb.) Kütz.	406	420	10	345	830		3	1	40	1		42	113
TOTAL PHYTOPLANKTON	2521	2147	823	1356	1801	834	514	421	1803	656	453	1034	464

TABLE 2. RELATIVE ABUNDANCE OF DIATOMS IN TOTAL PHYTOPLANKTON.

Percent composition of dominant genera and species found in numbers of at least fifty cells in 1 ml., in at least several samples. Species or genera present in numbers fewer than 50 cells in ml. are marked as very rare (vr), rare (r), quite common (qc), common (c) and very common (vc).

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
DIATOMS	86.73	89.17	89.51	89.21	86.65	87.83	87.24	84.86	66.21	68.43	68.40	88.80	89.61	88.64	84.94	81.04	80.81	69.03	63.18
CENTRALES	83.35	85.39	83.15	83.82	78.26	76.11	78.46	77.46	54.33	63.15	55.24	82.96	85.00	68.63	64.45	57.64	57.26	26.60	26.99
Cyclotella atomus Hust.																			
C. bodanica Eulenst.																vr			
C. comta (Ehr.) Kütz.			0.19	0.09	0.61	0.66	0.09	0.21	0.50		0.23			0.74	0.58	0.60	0.72	0.83	0.40
C. comta v. *oligactis* (Ehr.) Grun.																			
C. comensis Grun.																			
C. cryptica Reimann, Lewin and Guillard																			
C. kützingiana Thw.	0.17		0.19	0.09	0.67	0.23	0.53	0.21	1.00	2.26	0.23			0.47	0.35	0.80	0.60	1.65	1.19
C. kützingiana v. *radiosa* Fricke																			
C. meneghiniana Kütz.			1.67	1.01										0.09	0.10	0.60		vr	
C. meneghiniana v. *plana* Fricke																			
C. michiganiana Skv.	49.30	49.00	34.46	35.40	33.19	23.45	32.01	32.42	12.12	15.60	6.95	46.10	58.61	34.20	29.20	23.98	25.05	2.48	4.51
C. ocellata Pant.	0.17	0.90	1.46	0.36	4.31	4.66	3.65	3.02	5.87	3.40	5.60			2.42	3.77	3.08	4.64	4.30	3.97
C. operculata (Agardh) Kütz.	0.34	0.74	.09						0.50		1.00			0.18	0.33	0.35	0.66	0.01	
C. pseudostelligera Hust.																			
C. stelligera (Cleve & Grun.) V.H.																			
C. striata (Kütz.) Grun.	0.85	0.50	0.28	0.18	0.20	1.37	0.81	0.03	2.75	0.20	2.50	0.65	1.61	0.93	0.67	0.60	0.78	0.03	0.53
Cyclotella sp. #3																			
Coscinodiscus subsalsa Juhl.-Dannf.	0.34	0.38	0.19	0.27	0.20	0.12	0.48	0.12			0.11	0.55	0.35	0.47	0.16	0.80	0.66	0.01	0.13
Coscinodiscus sp.																			
Melosira granulata (Ehr.) Ralfs	9.00	5.35	8.08	14.14	8.46	11.50	8.98	10.98	6.41	13.35	9.72	7.79	3.60	4.63	6.55	9.29	4.70	5.36	7.84
M. granulata v. *angustissima* O. Müll.	18.75	18.70	33.75	30.19	26.71	32.04	28.96	28.79	20.36	27.18	27.88	20.15	14.19	20.04	17.00	14.10	15.39	9.02	7.07
M. granulata fo. *spiralis* Grun.																			

Table 2 (cont.)

MONTH STATION DEPTH, METERS	September 1968 FP 1	 6.6	 MP 1	 6	 EP 1	 6.6	 LAKE(5) 1	 8	 LAKE(1) 1	 10	 17	October 1968 FP 1	 7.5	 MP 1	 7	 EP 1	 6.6	 LAKE 1	 9
M. islandica O. Müll.																			
M. italica subsp. *subarctica* O. Müll.																			
M. varians Ag.			0.01		0.07		0.09	0.81				0.08	0.23	0.18	0.24	0.35	0.17		
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	0.34		0.19	0.73	1.01	0.23	0.09	0.56	1.16	0.20	0.35	0.23		1.49	1.93	1.69	1.21	1.24	0.53
S. astraea (Ehr.) Grun.	0.17	0.13	0.09		0.34	0.11	0.32	0.21	0.84	1.36	0.23	1.63	1.48	0.74	0.49	0.44	0.29	0.41	
S. binderanus (Kütz.) Krieg.																			
S. hantzschii Grun.	0.34	0.13	0.19	0.36	0.07		0.32		0.50		0.11	0.09	0.32	0.09			0.25	0.03	
S. minutus Grun. ex Cleve & Müll.																			
S. niagarae Ehr.	vr			vr					vr		vr			vr	vr	vr	r		
S. niagarae v. *magnifica* Fricke																			
S. subtilis (Van Goor) A. Cl.														vr					
S. tenuis Hust. ex Huber-Pestalozzi	2.70	3.00	2.04	0.73	2.15	1.63	1.22	0.49	0.50		0.11	3.26	2.75	0.74	1.26	0.60	1.50		
S. transsilvanicus Pant.	0.68	6.30	0.19	0.18	0.27	0.12	0.81	0.21	1.38		0.11	2.39	1.82	1.12	1.74	0.34	0.49	0.03	0.69
Rhizosolenia eriensis H. L. Smith							0.09		0.50									0.01	0.13
R. gracilis H. L. Smith											vr								
Thalassiosira #1																			
Actinoptychus sp.																			
PENNALES	3.38	3.78	6.36	5.99	8.39	11.72	8.78	7.40	11.88	5.28	13.16	5.84	4.61	20.01	20.49	23.40	23.55	42.43	36.19
Achnanthes affinis Grun.																			
A. clevei Grun.	r		r			vr	vr				r	r	r	vr	vr				vr
A. clevei v. *rostrata* Hust.																			
A. conspicua A. Mayer	r	qe	qe	qe	vr	vr	vr	r			vr			r	vr	vr	vr	vr	

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
A. deflexa Reim.			vr																
A. exiqua Grun.	c	r	r				vr	vr					vr	vr		vr	vr		
A. exiqua v. *constricta* (Grun.) Hust.																			
A. flexella (Kütz.) Brun.																		vr	
A. hungarica (Grun.) Grun.																	vr		
A. hauckiana Grun.														vr	vr		vr		
A. hauckiana v. *rostrata* Schulz												vr	vr		vr	vr	vr		
A. lanceolata (Bréb.) Grun.	c	r	r			vr	vr	r				qc	vr	r	vr		r		
A. lanceolata v. *apiculata* Patr.																			
A. lanceolata v. *dubia* Grun.	c	qc	c	vc	vr	vr	r	vr	vr		r	qc	vc	c	vr	vc	c	r	
A. lanceolata v. *omissa* Reim.																		vr	
A. lanceolata v. *elliptica* Cleve																			
A. lanceolata v. *bimaculata* Hust.																			
A. lauenburgiana Hust.																			
A. linearis (Wm. Smith) Grun.																			
A. lemmermanni Hust.																			
A. lanceolatoides Sov.																			
A. microcephala (Kütz.) Grun.																		vr	vr
A. minutissima Kütz.																		vc	
A. oestrupi (A.Cl.) Hust.																			
A. pinnata Hust.	r		qc		vr	vr	vr	vr				r	r	vr	vr	r	qc	vr	
A. wellsiae Reim.																			
Achnanthes sp. #1							vr	vr				vr	vr	vr	vr		r		
Achnanthes sp. #6						vr	vr												
Achnanthes sp. #14					r	vr													
Achnanthes sp. #15				r															
Achnanthes sp. #23																			

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Amphora bullatoides Hohn & Helleman																			
A. calumetica (Thomas) Perag.																			
A. cruciferoides Stoermer			vr	vr		vr													
A. hemicycla Stoermer			vr																
A. huronensis Stoermer																			
A. michiganensis Stoermer																		ve	
A. neglecta Stoermer			e	e	e	e	ve	ve		vr	r	vr		r	r	qe	e	r	vr
A. normanii Rabh.																			
A. ovalis (Kütz.) Kütz.	r	r	r	r	vr	vr	r	r			vr		r	vr	vr	qe		vr	vr
A. ovalis v. *constricta* Skv.																	vr		
A. ovalis v. *gracilis* (Ehr.) V.H.			vr	vr								r	r	r		qe	vr		
A. ovalis v. *libyca* (Ehr.) Cleve			r	vr	vr	vr	r	vr	r		vr	vr	vr	r	r	r	r		vr
A. ovalis v. *pediculus* (Kütz.) V.H.	e	qe	r	r	vr	r	r	vr			r	r	ve	e	qe	e	e		
A. rotunda Skv.																			
A. sibirica Skv. & Meyer			qe	r	r	vr	qe	r						vr	vr	r	qe		
A. subcostulata Stoermer			e	qe	r	qe	qe	qe			r			r		vr	r	r	vr
A. veneta Kütz.																			
Amphora sp. (*veneta* v. *angularis*)																			
Genus *Asterionella* Hass.		vr	0.05	0.19	0.61	0.38	0.60	0.03	1.00	0.36	1.28	0.47	0.95	2.67	0.70	0.61	1.45	3.98	2.75
Asterionella bleakeleyi Wm. Smith																			
A. gracillima (Hantz.) Hérib.					0.06					0.18		0.06	0.20	0.55		0.07	0.72	0.84	0.88
A. formosa Hass.		vr	0.05	0.19	0.55	0.38	0.60	0.03	1.00	0.18	1.28		0.75	1.53	0.70	0.54	0.32	3.14	1.87
A. formosa v. *acaroides* Lemm.												0.41		0.59			0.41		

Table 2 (cont.)

MONTH	September 1968								October 1968										
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Cocconeis diminuta Pant.	r		vr	r	vr	vr		vr			r	r	r	r	vr		r	vr	vr
C. disculus (Schum.) Cleve			vr																
C. fluviatilis Wallace							vr												
C. placentula Ehr.																			
C. placentula v. *euglypta* (Ehr.) Cleve	qc	r	c	c	vr	vr	vr	vr		vr	vr	vc	c	qc	qc	r	r		
C. placentula v. *lineata* (Ehr.) V.H.			vr																
C. pediculus Ehr.	c	r	qc	r	vr	vr	vr	r			vr	qc	c	c	vr	c	c		
C. rugosa Sov.																			
C. thunensis A. Mayer						vr		vr				vr	r	vr			vr	vr	vr
Cocconeis sp. #6																			
Cymbella amphicephala Nag. ex Kütz.	vr		vr																
C. affinis Kütz.																			
C. cuspidata Kütz.				vr															
C. cistula (Ehr.) Kirchn.			vr																
C. cymbiformis (Agardh? Kütz.) V.H.					vr													r	
C. cesatii Grun.																			
C. delicatula Kütz.																			
C. ehrenbergii Kütz.																		r	
C. helvetica Kütz.				vr															
C. hustedtii Krasske																			
C. lanceolata (Ehr.) Kirchn.		vr																c	r
C. laevis Nag.																		vr	
C. latens Krasske																			
C. prostrata (Berkeley) Cleve																			
C. reinhardtii Grun.															vr			r	
C. leptoceros v. *rostrata* Hust.																			

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	FP		MP		EP		LAKE(5)		LAKE(1)			FP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
C. sinuata Greg.																		vr	
C. subventricosa Choln.																			
C. tumida (Bréb.) V.H.	vr		vr									vr							
C. turgida Greg.					vr														
C. turgida v. *pseudogracilis* Choln.									vr			r	vr		vr	vr	r		
C. triangulata (Ehr.) Cleve																			
C. turgidula Grun.																			
C. ventricosa Agardh					vr													vr	
Cymbella cistula v. #1							vr											vr	
Cymbella sp. #2				vr															
Cymbella sp. #6																			
Cymbella sp. #18																			
Cymbella sp. #21																			
Cymbella spp.			r																
Genus *Diatoma* Bory	0.09		0.01	0.02	0.27	0.05	vr	vr	0.25	0.18	0.46	0.10		0.95	0.80	0.55	0.50	1.04	0.46
D. ehrenbergii Kütz.																			
D. tenue Ag.																			
D. tenue v. *elongatum* Lyngb.	vr		r	vr	0.27	0.05	vr	vr	0.25	0.18	0.46			0.95	0.80	0.50	0.50	1.04	0.46
D. tenue v. *pachycephala* Grun.																			
D. vulgaris Bory	0.09	vr	vr	r	vr	vr			vr		vr	0.10	r	r	vr	0.05	r		vr
D. vulgaris v. *brevis* Grun.																			
D. vulgaris v. *linearis* V.H.																			
Genus *Fragilaria* Lyngb.	0.71	1.31	2.26	1.28	0.20	4.99	2.80	2.63	5.53	2.59	5.23	1.15	0.37	10.95	13.98	16.07	15.47	33.33	27.31
F. brevistriata Grun.	e						c	qc			r	vc	qc	qc		e	e	r	r
F. brevistriata v. *inflata* (Pant.) Hust.								vr											

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	FP		MP		EP		LAKE(5)		LAKE(1)			FP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
F. brevistriata v. *capitata* Hérib.																			
F. capucina Desm.							0.02					0.12	vr	4.19	3.50	2.61	2.15	9.96	9.35
F. capucina v. *mesolepta* Rabh.																			
F. capucina v. *lanceolata* Grun.																			
F. construens (Ehr.) Grun.	e	e	vc	vc	qc	r	c	e				vc	qc	vc	r		qc		
F. construens v. *venter* (Ehr.) Grun.																			
F. construens v. *binodis* (Ehr.) Grun.												vr							
F. construens v. *pumila* Grun.															qc			r	
F. construens v. *minuta* Temp. and Perag.																			
F. crotonensis Kitt.	0.15	1.07	1.90	1.08	0.04	3.86	0.92	1.80	5.53	2.59	4.41	0.03	0.17	5.84	10.00	11.46	11.79	22.33	16.87
F. intermedia Grun.	qc		c	c		qc	qc	r			r		vr	qc	vr	r	c	e	r
F. intermedia v. *fallax* Grun.																			
F. leptostauron (Ehr.) Hust.			vr	r															
F. leptostauron v. *dubia* (Grun) Hust.												r				qc	qc		
F. leptostauron v. *fossilis* (Pant.) Reháková																vr	r		
F. lapponica Grun.																			
F. pinnata Ehr.	qc	c	vc	vc	qc	qc	qc	qc	vr	vr	r	vc	qc	qc	qc	qc	qc	r	r
F. pinnata v. *lancettula* (Schum.) Hust.																			
F. pinnata v. *intercedens* (Grun.) Hust.												vr				qc	r		r
F. vaucheriae v. *capitellata* (Grun.) Patr.																			
F. vaucheriae v. *fallax* Grun.					qc														
F. vaucheriae v. *truncata* Grev.																			

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
F. crotonensis varieties																			
Fragilaria sp. #6																			
Fragilaria sp. #9																			
Fragilaria sp. #11																			
Gomphonema acuminatum v. *pusillum* Grun.																			
G. acuminatum v. *coronata* (Ehr.) Rabh.																			
G. abbreviatum v. *inflata* Hust.																			
G. angustatum (Kutz.) Rabh.	r	vr	r	vr				r			vr	qc	r	vr	vr	vr	r		
G. angustatum v. *producta* Grun.																			
G. bohemicum Reich. & Fricke			vr								vr	vr					vr		
G. constrictum Ehr.	vr																		
G. clevei Fricke																		vr	
G. constrictum v. *capitata* (Ehr.) Cleve																			
G. grovei M. Schm.																			
G. gracile Ehr.																			
G. gracile v. *cymbelloides* Grun.																			
G. intricatum Kütz.																		r	
G. intricatum v. *dichotomum* (Kütz.) Grun.																			
G. lanceolatum Ehr.																			
G. longiceps v. *subclavata* Grun.																			
G. lanceolatum v. *insignis* (Greg.) Cleve																			
G. olivaceum (Lyngb.) Kütz.	c	qc	c	vr	vr	vr		vr	vr		vr	qc	qc	vr	r	vc	qc	vr	r
G. olivaceum v. *minutissima* Hust.			vr																
G. olivaceum v. *calcarea* Cleve																			

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	FP		MP		EP		LAKE(5)		LAKE(1)			FP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
G. parvulum (Kütz.) Kütz.																			
G. subclavatum Grun.				vr															
G. sphaerophorum Ehr.																		r	
G. tergestinum (Grun.) Fricke																			
Gomphonema sp. #2																		r	
Gomphonema sp. #3																			
Gomphonema sp. #10																			
Gomphonema spp.				r															
Genus *Navicula* Bory	0.53	0.21	1.23	0.98	2.43	2.06	1.10	0.87	0.08	0.12	0.12	0.99	0.70	0.78	0.51	0.64	0.74	0.31	0.64
N. anglica Ralfs																			
N. anglica v. *subsalsa* (Grun.) Cleve																			
N. anglica v. *signata* Hust.																			
N. aurora Sov.							vr											vr	
N. bacillum Ehr.																			
N. capitata Ehr.	r						vr					r	vr	r		vr			
N. capitata v. *hungarica* (Grun.) Ross					vr	r	r										vr		
N. capitata v. *luneburgensis* (Grun.) Patr.					qe	qe	r	r								r	r		
N. cuspidata Kütz.																	vr		
N. cupsa Hohn																			
N. cincta (Ehr.) Ralfs																			
N. clementis Grun.																			
N. clementis v. *linearis* Bander																			
N. clementis v. *quadrisigmata* Mang.							vr										vr		
N. costulata Grun.			r	e			qe	r	vr	vr	r					vr	vr	r	qe
N. contenta v. *biceps* (Arn.) V.H.																			

Table 2 (cont.)

MONTH	September 1968															October 1968			
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
N. confervacea (Kütz.) Grun.																			
N. crucicula (W. Sm.) Donk.																			
N. cuspidata v. *obtusa* Patr.																			
N. exilis Patr.													vr						
N. cryptocephala Kütz.				vr													vr		
N. cryptocephala v. *intermedia* Grun.	c	c			vr	vr	vr	vr				vc	vc	vr	vr	r	r		
N. cryptocephala v. *veneta* (Kütz.) Rabh.																			
N. decussis Øst.	qc	qc	vc	vc	r	r	qc	qc		r	r	c	c	c	r	vc	c	vr	r
N. elginensis (Greg.) Ralfs																			
N. elginensis v. *rostrata* (A. Mayer) Patr.																			
N. exiguaformis Hust.																			
N. exigua Greg. ex Grun.																			
N. explanata Hust.																			
N. gastrum (Ehr.) Kütz.	vr	r	vr	r	vr	vr	vr	vr				r							
N. gastrum v. *signata* Hust.														vr	vr	vr	vr		
N. gregaria Donk.			vr	qc		vr		r						vr			vr		
N. gastriformis Hust.																			
N. grimmei Krasske																			
N. [illegible] Meist.																			
N. heufleri Grun.																			
N. hassiaca Krasske																			
N. integra (Wm. Smith) Ralfs																			
N. ingenua Hust.																			
N. insolita Hust.				vr															
N. imbricata Bock																			
N. lacustris Greg.																			
N. latens Krasske	vr		vc		vc	vc	vc	vc			vr	vr		r	c	qc	qc		vr
N. lanceolata (Agardh) Kütz.																			

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
N. menisculus Schum.																			
N. menisculus v. *upsaliensis* Grun.								vr											
N. mutica v. *tropica* Hust.				vr															
N. mutica v. *cohnii* (Hilse) Grun.															vr			qe	
N. minima Grun.																			
N. oblonga (Kütz.) Kütz.				vr															
N. ... Wallace																			
N. cryptata Hust.																			
N. paludosa Hust.																			
N. peratomae Hust.																			
N. placentula (Ehr.) Kütz.			vr																
N. placentula v. *rostrata* A. Mayer								vr						vr		vr			vr
N. platystoma v. *pantocsekii* Wisl. and Kolbe																			
N. platystoma Ehr.		vr	qe	r	vr	r	r	r											
N. protracta Grun.														vr			r		
N. protracta v. *elliptica* Gallik																			
N. peregrina (Ehr.) Kutz.																			
N. pupula Kütz.																			
N. pupula v. *capitata* Skv. and Meyer							vr												
N. pupula v. *rectangularis* (Greg.) Grun.	r																		
N. pupula v. *mutata* (Krasske) Hust.																			
N. pupula v. *rostrata* Hust.			vr	vr	e	qe	r	r			vr			vr		vr	qe		
N. pygmaea Kütz.	vr																		
N. radiosa Kütz.																			
N. radiosa v. *parva* Wallace		vr	vr		vr		vr					vr				vr		vr	

Table 2 (cont.)

MONTH	September 1968											October 1968								
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
N. radiosa v. *tenella* (Bréb.) Grun.																			
N. reinhardtii (Grun.) Grun.																			
N. reinhardtii v. *elliptica* Herib.																			
N. rhynchocephala Kütz.																			
N. rhynchocephala v. *germainii* (Wallace) Patr.																			
N. rhynchocephala v. *amphiceros* (Kütz.) Grun.											vr						r		
N. rotunda Hust.																			
N. sabiniana Patr. ?				vr															
N. scutelloides Wm. Smith	vr		vr	vr															
N. schroeteri v. *escambia* Patr.												r			vr			vr	
N. seminulum Grun.																			
N. simplex Krasske																			
N. stroesei A. Cl.																			
N. symmetrica Patr.															vr				
N. tantula Hust.																			
N. texana Patr. ?																			
N. tripunctata (O.F. Müll.) Bory	qc	c	r	qc		vr	vr	vr	vr		vr	e	qc	r	vr	r	qc	vr	r
N. tripunctata v. *cuneata* Lauby																			
N. tripunctata v. *schizonemoides* (V.H.) Patr.																			
N. tuscula Ehr.					vr		vr	vr											
N. tuscula fo. *obtusa* Hust.																			
N. tuscula fo. *rostrata* Hust.																			
N. vanheurckii Patr.																			
N. varicostriata Krasske			vr	vr															
N. viridula (Kütz.) Kütz.	vr			r	vr		vr							vr	vr		r		
N. viridula v. *avenacea* (Bréb.) V.K.	vr																		

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		SP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
N. viridula v. *linearis* Hust.																			
N. viridula v. *rostellata* (Kütz.) Cleve																			
N. vulpina Kütz.							vr												
N. wittrockii (Lagerst.) A. Cl.																			
Navicula sp. (*pygmaea* v. *producta*)	qe																		
Navicula sp. #8 (*aff. lanceolata*)							vr	vr				qe	vr	vr	vr	vr	vr		
Navicula sp. #18																			
Navicula sp. #19																			
Navicula sp. #22																			
Navicula sp. #23							vr												
Navicula sp. #25																			
Navicula sp. #27																			
Navicula sp. #36																			
Navicula sp. #33				vr															
Navicula sp. #40																			
Navicula sp. #43																			
Navicula sp. #44																			
Navicula sp. "A"	vr		r	qc	r	r	qc	r qc	vr									vr	
Navicula sp.														vr	vr	r	r	vr	
Navicula sp.												vr	vr						
Navicula sp.												vr							
Navicula sp.																	vr		
Navicula sp.																			
Navicula sp.																			
Navicula sp.																			
Genus *Nitzschia* Hass.																			
N. acicularis (Kütz.) Wm. Smith	0.64	1.12	1.39	1.42	2.77	2.23	1.95	2.00	1.00	0.60	1.86	1.20	1.08	2.04	1.57	2.93	3.26	0.94	2.20

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
N. acuminata (Wm. Smith) Grun.																			
N. acuta Hantz.																			
N. amphibia Grun.						r	r					r	vr	vr		vr	r		
N. amphibia v. *fossilis* Grun.																			
N. angustata (Wm. Smith) Grun.		vr	vr	r														vr	
N. angustata v. *acuta* Grun.	vr													vr	vr		vr		
N. apiculata (Greg.) Grun.		r											vr				vr		
N. bacata Hust.																			
N. capitellata Hust.			vr		vr														
N. commutata Grun.																			
N. confinis Hust.																			
N. denticula Grun.																			
N. dissipata (Kütz.) Grun.		r	e	r	vr	vr	vr	vr	vr	vr	r	qe	r	r	vr	vr	qe	r	
N. dissipata v. *media* (Hantz.) Grun.																			
N. fonticola Grun.																			
N. frustulum (Kütz.) Grun.	r	vr	vr	r								vr				vr	vr		
N. frustulum v. *perminuta* Grun.	r		qe	r		vr	vr					qe	qe	e	e	e	ve	vr	vr
N. frustulum v. *perpusilla* (Rabh.) Grun.			vr																
N. hungarica Grun.	r	vr	r		vr		r	vr				r	r			vr			
N. helvetica Hust.																		vr	
N. interrupta (Reich.) Hust.																			
N. [illegible] Hust.																			
N. linearis Wm. Smith		r	vr	r								r				vr			
N. palea (Kütz.) Wm. Smith	ve	e	r	r	e	r	qe	vr	vr	r	r	ve	ve	e	e	e	ve	vr	r
N. parvula Wm. Smith																			
N. recta Hantz.		r	r	r															
N. romana Grun.																			
N. sigmoidea (Kütz.) Wm. Smith			r	r								r	vr		vr				
N. sigma (Kütz.) Wm. Smith												vr							

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
N. epiculoides Hust.																			
N. sublinearis Hust.				r										vr			vr		
N. subtilis (Kütz.) Grun.														r	vr				
N. stagnorum Rabh.					qc	r	r	vr							vr	vr	vr		vr
N. thermalis (Ehr.) Auersw.			r	r								qc	r				vr		
N. thermalis v. *intermedia* Grun.																			
N. thermalis v. *minor* Hilse																			
N. tryblionella Hantz.		vr	vr				vr	vr					vr	vr					
N. tryblionella v. *debilis* (Arn.) A. Mayer																			
N. tryblionella v. *levidensis* (Wm. Smith) Grun.	r			qc									vr						
N. tryblionella v. *victoriae* Grun.																			
N. wolterecki Hust.	r		qc	r			vr	vr			r	vr		vr			vr	vr	
Nitzschia sp. "A"																			
Nitzschia sp. "B"		c									r								
Nitzschia sp. #1			r		vr		vr	vr			r			r	r	c	vc	r	r
Nitzschia sp. #2	c	c			vr	vr	r	vr				vc	qc	vr			r	qc	c
Nitzschia sp. #6							vr							vr		vr			
Nitzschia sp. #7																			
Nitzschia sp. #8																			
Nitzschia sp. #9																			
Nitzschia sp.																			
Nitzschia sp.																			
Nitzschia sp.																			
Nitzschia spp.			c	r			vr										r		
Genus *Synedra* Ehr.	0.51	0.73	0.50	0.53	0.27	0.49	0.60	0.36	1.00	0.18	4.65	1.12	0.88	1.12	0.72	0.64	0.83	0.31	0.73
S. acus Kütz.			vr						vr										
S. amphicephala Kütz.																			

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	FP		MP		EP		LAKE(5)		LAKE(1)			FP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
S. capitata Ehr.																			
S. delicatissima Wm. Smith	a	e		vr	vr														
S. delicatissima v. *angustissima* Grun.									vr	vr									
S. deronense Grun.	r																		
S. fasciculata (Agardh) Kütz.									vr		vr					vr	vr		
S. filiformis Grun.							vr												
S. filiformis v. *exilis* A.Cl.																vr			
S. minuscula Grun.																			
S. ostenfeldii (Krieg.) A.Cl.																			
S. parasitica (W. Smith) Hust.												vr							
S. parasitica v. *subconstricta* (Grun.) Hust.		vr																	
S. pulchella Ralfs	r		e	e	qe	qe	qe	r				e		e	qe	e	e		
S. pulchella v. *lanceolata* O'Meara																			
S. pulchella v. *lacerata* Hust.																			
S. rumpens Kütz.																			
S. rumpens v. *fragilarioides* Grun.																			
S. tenera Wm. Smith																		e	
S. ulna (Nitz.) Ehr.	e	qe	e	e	vr	r	r	r	qe		qe	vc	vc	e	e		qe		r
S. ulna v. *chaseana* Thomas	r		r	vr		vr	qe	vr	vr	vr	qe	r	r						
S. ulna v. *contracta* Østr.	r																	vr	r
S. ulna v. *constricta* Venkt.																			
S. ulna v. *claviceps* Hust.									vr										

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
S. ulna v. *danica* (Kütz.) V.H.		vr																	
S. ulna v. *longissima* (Wm. Smith) Brun.									vr	vr	vr	vr	vr				vr		
S. ulna v. *subaequalis* (Grun.) V.H.																			
S. ulna v. *spathulifera* (Grun.) V.H.																			r
S. ulna v. *oxyrhynchus* (Kütz.) V.H.							r					r	vr						
Synedra sp. (*vaucheriae* v. *fragilarioides*)																			
Synedra sp. (*capitata* v. *foetida*)																			
Synedra sp. "A"																			
Genus *Tabellaria* Ehr.	vr	0.02	0.09	0.11	0.14	0.33	0.62	0.12	2.17	0.99	2.90	vr		0.24	1.18	0.81	0.25	1.36	1.19
T. fenestrata (Lyngb.) Kütz.	vr	0.02	0.09	0.11	0.14	0.33	0.62	0.12	2.17	0.99	2.90	vr		0.24	1.18	0.81	0.25	1.36	1.19
T. fenestrata v. *geniculata* A.Cl.																			
T. flocculosa (Roth) Kütz.				vr				vr											
Amphiprora ornata Bail.		vr		vr									vr						
Amphipleura pellucida (Kütz.) Kütz.																			
Anomoeoneis sphaerophora (Ehr.) Pfitz.																		vr	
Bacillaria paxillifer (O.F. Müll.) Hendy			vr														vr		

Table 2 (cont.)

MONTH	September 1968								October 1968										
STATION	FP		MP		EP		LAKE(5)		LAKE(1)			FP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Caloneis amphisbaena (Bory) Cleve						vr		vr								vr			
C. bacillum (Grun.) Cleve							r										vr		
C. bacillaris v. *thermalis* (Grun.) A.Cl.																			
C. bacillum v. *lancettula* (Schulz) Hust.																			
C. lewisii Patr.																			
C. ventricosa (Ehr.) Meist.																			
C. ventricosa v. *truncatula* (Grun.) Meist.			qe	qe	vr	vr	qe	vr						r			r	vr	
C. ventricosa v. *subundulata* (Grun.) Patr.																			
Cymatopleura elliptica (Bréb. & Godey) Wm. Smith																			
C. solea (Bréb. & Godey) Wm.Smith	vr	vr	vr	vr							vr						vr		vr
C. solea v. *apiculata* (Wm. Smith) Ralfs						vr					vr		vr	vr			vr		
Denticula tenuis v. *crassula* (Naeg.) Hust.	vr																		
Diploneis puella (Schum.) Cleve			r		vr			vr			vr						vr		
D. populi (Schmidt) Cleve																			
D. subovalis Cleve																			
Diploneis sp. #1																			
Diploneis sp.																			
Diploneis sp.																			

Table 2 (cont.)

MONTH	September 1968											October 1968									
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Epithemia argus (Ehr.) Kütz.		vr																	
E. intermedia Fricke			vr																
E. sorex Kütz.			vr																
E. turgida (Ehr.) Kütz.													vr				vr	vr	
E. zebra (Ehr.) Kütz.																			
E. zebra v. *porcellus* (Kütz.) Grun.																		vr	
Epithemia sp.				vr									vr						
Eunotia arcus Ehr.			r																
E. arcus v. *bidens* Grun.																			
E. curvata (Kütz.) Lagerst.																			
E. formica Ehr.																			
E. pectinalis v. *minor* (Kütz.) Rabh.																			
E. pectinalis v. *ventricosa* Grun.																			
E. vanheurckii Patr.																			
Eunotia sp.																			
Frustulia rhomboides v. *amphipleuroides* (Grun.) Cleve																			
F. vulgaris (Thw.) DeToni																			
F. weinholdii Hust.																			
Frustulia sp.																			
Gyrosigma acuminatum (Kütz.) Rabh.							vr												
G. attenuatum (Kütz.) Rabh.																			
G. spencerii v. *curvula* (Grun.) Reim.																			
G. scalproides (Rabh.) Cleve																			
G. wormleyi (Sulliv.) Boyer																			
Gyrosigma sp.																	vr		

Table 2 (cont.)

MONTH	September 1968													October 1968					
STATION	FP		MP		EP		LAKE(5)		LAKE(1)			FP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Hantzschia amphioxys (Ehr.) Grun.																			
Mastogloia grevillei W. Smith																			
M. smithii Thw.																			
M. smithii v. *lacustris* Grun.																			
Meridion circulare (Grev.) Agardh		VR	VR	VR							VR	VR		VR	VR		VR	VR	
M. circulare v. *constrictum* (Ralfs) V.H.																			
Neidium affine (Ehr.) Pfitz.																			
N. binode (Ehr.) Hust.																			
N. dubium (Ehr.) Cleve			VR	VR								VR			VR		VR		
N. dubium fo. *constrictum* Hust.																			
N. iridis (Ehr.) Cleve						VR										VR		VR	
N. iridis v. *amphigomphus* (Ehr.) A. Mayer																VR			
N. productum (Wm. Smith) Cleve																			
N. terpenci Reim.			VR																
Neidium sp. #3																			
Neidium sp.																			
Oestrupia zachariasi (Reich.) Stoermer																			
O. zachariasi v. *undulata* (Schulz) Stoermer			VR				VR	VR											
Cymbella martyi Hérib.											r		VR						VR
Pinnularia abaujensis (Pant.) Ross																			
P. acrosphaeria Wm. Smith			VR																
P. biceps Greg.																			
P. biceps fo. *petersenii* Ross																			

Table 2 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE(5)		LAKE(1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
P. brebissonii (Kütz.) Rabh.																			
P. borealis Ehr.																			
P. burkii Patr.																			
P. intermedia (Lagerst.) Cleve																			
P. leptosoma (Grun.) Cleve																			
P. obscura Krasske																			
P. rupestris Hantz.																			
Pinnularia sp.																			
Rhoicosphenia curvata (Kütz.) Grun.	r	r	vr	r		vr	vr	vr				e	e	qe	qe	e	qe	r	r
Rhopalodia gibba (Ehr.) O. Müll.																			
Rh. gibberula (Ehr.) O. Müll.																			
Stauroneis acutiuscula Perag. & Hérib.																			
S. anceps fo. *gracilis* Rabh.																			
S. anceps fo. *linearis* (Ehr.) Hust.																			
S. phoenicenteron (Nitz.) Ehr.																			
S. phoenicenteron fo. *gracilis* (Ehr.) Hust.																			
S. kriegeri Patr.																			
S. smithii Grun.																			
Stauroneis sp.																			
Surirella angustata Kütz.																			
S. linearis Wm. Smith																vr			
S. linearis v. *constricta* (Ehr.) Grun.																			
S. ovata Kütz.	vr		vr	vr															
S. ovata v. *pinnata* (Wm.Smith) Hust.												vr			vr	vr	qe		
S. robusta v. *splendida* (Ehr.) V.H.																			
Surirella sp.					vr	vr					r						vr		
Tropidoneis lepidoptera v. *proboscidea* Cleve																			

Table 2 (cont.)

MONTH / STATION / DEPTH, METERS	November 1968 PP 1	PP 6.6	MP 1	MP 7	MP 9	EP(1) 1	EP(1) 5	EP(1) 9	EP(2) 1	EP(2) 5	EP(2) 9	LAKE 1	LAKE 10	LAKE 25	LAKE 28
DIATOMS	90.81	86.66	71.48	62.20	87.46	60.84	58.94	79.50	52.24	50.12	80.25	53.27	45.58	90.65	93.88
CENTRALES	86.41	80.39	27.16	24.21	58.24	23.11	16.04	12.68	19.17	16.69	40.26	14.98	15.38	33.66	36.20
Cyclotella atomus Hust.															
C. bodanica Eulenst.			vr												
C. comta (Ehr.) Kütz.		0.50	0.80	4.61	1.23	1.46	0.53	0.81	1.72	1.82	3.97	0.80	1.96	3.45	0.42
C. comta v. *oligactis* (Ehr.) Grun.			r	qc	r	r	r		qc	qc	c			qc	
C. comensis Grun.															
C. cryptica Levin, Reimann & Guillard							0.04								
C. Kützingiana Thw.	0.18		2.44	2.94	3.49	2.01	1.74	2.25	3.10	3.85	3.10	1.95	3.53	4.24	2.60
C. Kützingiana v. *radiosa* Fricke			c	qc	vc	c	c	c	c	c	c	qc	qc	qc	c
C. meneghiniana Kütz.	4.21	4.53			1.53		0.04				0.31	0.09		0.17	1.05
C. meneghiniana v. *plana* Fricke	53.36	48.81	1.41	0.75	21.38	0.92	1.15	0.91	0.92	0.43	6.94	4.01	3.92	3.84	3.76
C. michiganiana Skv.		0.49	2.41	1.51	2.86	2.57	2.43	3.62	2.87	1.07	2.11	1.72	0.78	4.48	1.75
C. ocellata Pant.	0.18		0.41	0.21	0.32		0.25	0.23	0.34		0.50			1.36	0.26
C. operculata (Agardh) Kütz.															
C. pseudostelligera Hust.							0.04							0.17	
C. stelligera (Cleve & Grun.) V.H.			0.54		0.32	0.22	0.40	0.37	0.69	0.21		0.92	0.14	0.17	0.64
C. striata (Kütz.) Grun.															
Cyclotella sp. #3															
Coscinodiscus subsalsa Juhl.-Dannf.	1.17	0.25		0.21	1.03		0.04	0.20			0.74			0.17	0.12
Coscinodiscus sp.							0.04								
Melosira granulata (Ehr.) Ralfs	7.86	7.28	7.50	9.21	13.00	6.50	2.88	0.51	3.11	3.18	5.70	0.78	2.71	4.81	10.58
M. granulata v. *angustissima* O. Müll.	9.51	9.20	7.76	2.25	2.88	8.00	3.04	1.00	4.58	4.74	13.30	3.31	1.51	5.00	10.70
M. granulata fo. *spiralis* Grun.															

Table 2 (cont.)

MONTH STATION DEPTH, METERS	November 1968 FP 1	 6.6	 MP 1	 7	 9	 EP(1) 1	 5	 9	 EP(2) 1	 5	 9	 LAKE 1	 10	 25	 28
M. islandica O. Müll.															
M. italica subsp. *subarctica* O. Müll.															
M. varians Ag.	0.47	0.25									0.18		0.14		0.04
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	0.48	0.26	2.20	1.97	4.09	0.55	1.06	1.68	1.04	0.86	1.55	0.17	0.14	3.92	1.69
S. astraea (Ehr.) Grun.	0.18	0.76	0.62	0.14	0.16		0.47	0.50	0.23	0.21	0.18	0.46	0.14	0.29	0.64
S. binderanus (Kütz.) Krieg.															
S. hantzschii Grun.	0.35	0.50	0.08	0.07	1.03	0.18	0.37	0.07	0.23	0.09	0.43	0.09		0.12	0.26
S. minutus Grun. ex Cleve & Müll.							0.16							0.40	
S. niagarae Ehr.			r	r	qc						r				vr
S. niagarae v. *magnifica* Fricke					r		vr								
S. subtilis (Van Goor) A. Cl.	3.04	3.02	0.12	0.07	1.23	0.18	0.16	0.11			0.43	0.34	0.14	0.40	0.64
S. tenuis Hust. ex. Huber-Pestalozzi	5.39	4.53	0.33	0.07	2.66	0.18	1.03	0.30	0.34	0.10	0.43	0.17	0.27	0.64	0.95
S. transilvanicus Pant.			0.37		0.13	0.18	0.04	0.12		0.09	0.18	0.09			0.08
Rhizosolenia eriensis H. L. Smith															
R. gracilis H.L. Smith															
Thalassiosira #1															
Actinoptychus sp.															
PENNALES	4.40	6.27	44.32	33.99	29.22	37.83	42.90	66.82	33.07	33.43	39.99	38.29	30.20	56.99	57.68
Achnanthes affinis Grun.															
A. clevei Grun.	qc	r	vr	vc	vc		vr	r			r	vr	vr		r
A. clevei v. *rostrata* Hust.	vr	vr		qc	r		vr	vr			r			vr	
A. conspicua A. Mayer					r										

Table 2 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
A. deflexa Reim.															
A. exigua Grun.	r	r			qc										
A. exigua v. *constricta* (Grun.) Hust.	vr	vr									r				
A. flexella (Kütz.) Brun.															
A. hungarica (Grun.) Grun.	vr	vr									vr				
A. hauckiana Grun.					r									vr	
A. hauckiana v. *rostrata* Schulz	qc	qc			r									r	vr
A. lanceolata (Bréb.) Grun.	c	c		r	r		r	vr		r	c			qc	r
A. lanceolata v. *apiculata* Patr.															
A. lanceolata v. *dubia* Grun.	ve	vc	vr	e	ve			vr	vr	r	ve		vr	e	r
A. lanceolata v. *omissa* Reim.					vr										
A. lanceolata v. *elliptica* Cleve															
A. lanceolata v. *bimaculata* Hust.															
A. luenburgiana Hust.	qc	c		vr	r			vr			r			qc	vr
A. linearis (Wm. Smith) Grun.								vr							
A. lemmermanni Hust.															
A. lanceolatoides Sov.					r										
A. microcephala (Kütz.) Grun.				vr							vr				vr
A. minutissima Kütz.	vr			r		vr									vr
A. ocstrupi (A.Cl.) Hust.															
A. pinnata Hust.		vr		vr	vr	vr		vr						r	vr
A. welleiae Reim.															
Achnanthes sp. #1															
Achnanthes sp. #6															
Achnanthes sp. #14		vr													
Achnanthes sp. #15															
Achnanthes sp. #23															
Achnanthes spp.	r			r	r										

Table 2 (cont.)

MONTH STATION DEPTH, METERS	November 1968 PP 1	 6.6	 MP 1	 7	 9	 EP(1) 1	 5	 9	 EP(2) 1	 5	 9	 LAKE 1	 10	 25	 28
Amphora bullatoides Hohn & Helleman															
A. calumetica (Thomas) Perag.															
A. cruciferoides Stoermer															
A. hemicycla Stoermer															
A. huronensis Stoermer															
A. michiganensis Stoermer															
A. neglecta Stoermer	vr	vr	r	vc	e	r	vc	vc	vr	vr	vc	vr	vr	e	e
A. normanii Rabh.															
A. ovalis (Kütz.) Kütz.	vc	r	vr	e	r	vr	r	r		vr	e			vr	vr
A. ovalis v. *constricta* Skv.															
A. ovalis v. *gracilis* (Ehr.) V.H.	r			vr	r		vr	r			qc	vr		r	
A. ovalis v. *libyca* (Ehr.) Cleve		r	vr	r	c		vr	vr		r	c		vr	vr	
A. ovalis v. *pediculus* (Kütz.) V.H.	vc	vc	vr	e	vc			r		r	vc	r		vc	r
A. rotunda Skv.															
A. sibirica Skv. & Meyer				vr			vr	r			r				
A. subcostulata Stoermer	vr	vr	vr	vr	r						r			vr	vr
A. veneta Kütz.															
Amphora sp. (*veneta* v. *angularis*)															
Genus *Asterionella* Hass.	0.12	0.06	3.51	3.54	0.70	1.75	2.42	5.50	3.12	2.15	2.56	6.02	1.22	5.08	5.56
Asterionella bleakeleyi Wm. Smith															
A. gracillima (Hantz.) Hérib.								0.78			0.43	3.48			1.74
A. formosa Hass.	0.12	0.06	2.64	3.54	0.70	1.75	2.42	4.72	3.12	2.15	2.10	2.54	1.22	5.08	3.68
A. formosa v. *acaroides* Lemm.	vr	vr	0.87		vr						0.03				0.14

Table 2 (cont.)

MONTH STATION DEPTH, METERS	November 1968 PP 1	 PP 6.6	 MP 1	 MP 7	 MP 9	 EP(1) 1	 EP(1) 5	 EP(1) 9	 EP(2) 1	 EP(2) 5	 EP(2) 9	 LAKE 1	 LAKE 10	 LAKE 25	 LAKE 28
Cocconeis diminuta Pant.	c	vr		r	c		vr	r			qc			r	r
C. disculus (Schum.) Cleve											vr				
C. fluviatilis Wallace					r										
C. placentula Ehr.	r	r	vr	c	vc		vr	vr			vc			r	vr
C. placentula v. *euglypta* (Ehr.) Cleve	vc	c	vr	r	vc			vr			vc			r	r
C. placentula v. *lineata* (Ehr.) V.H.	qc	vr			r						vr				
C. pediculus Ehr.	c	r			qc							vr		vr	
C. rugosa Sov.															
C. thienemanni A. Mayer	r	vr	vr	vc	c	r'	r	vr			vc			vr	vr
Cocconeis sp. #6															
Cymbella amphicephala Näg. ex Kütz.															
C. affinis Kütz.															
C. cuspidata Kütz.															
C. cistula (Ehr.) Kirchn.	vr	vr	vr	vr	vr						vr				
C. cymbiformis (Agardh? Kütz.) V.H.															
C. cesatii Grun.	r														
C. delicatula Kütz.															
C. ehrenbergii Kütz.															
C. helvetica Kütz.															
C. hustedtii Krasske															
C. lanceolata (Ehr.) Kirchn.															
C. laevis Näg.															
C. latens Krasske															
C. prostrata (Berkeley) Cleve														vr	
C. reinhardtii Grun.															
C. leptoceros v. *rostrata* Hust.															

Table 2 (cont.)

MONTH STATION DEPTH, METERS	November 1968 PP 1	 6.6	 MP 1	 7	 9	 EP(1) 1	 5	 9	 EP(2) 1	 5	 9	 LAKE 1	 10	 25	 28
C. sinuata Greg.	r	vr		vr	qc						r				
C. subventricosa Cholm.															
C. tumida (Bréb.) V.H.															
C. turgida Greg.		vr													
C. turgida v. *pseudogracilis* Cholm.				vr											
C. triangulata (Ehr.) Cleve	r	r													
C. turgidula Grun.															
C. ventricosa Agardh	r	vr			vr						vr				
Cymbella cistula v. #1															
Cymbella sp. #2															
Cymbella sp. #6															
Cymbella sp. #13	vr														
Cymbella sp. #21															
Cymbella spp.															
Genus *Diatoma* Bory	0.08	0.03	1.87	0.28	1.45	1.98	4.19	4.17	1.06	1.29	2.18	0.33	0.14	2.89	2.66
D. ehrenbergii Kütz.															
D. tenue Ag.															
D. tenue v. *elongatum* Lyngb.	vr	vr	1.87	0.28	1.05	1.98	3.57	3.94	1.06	1.29	1.90	0.32	0.14	2.89	2.66
D. tenue v. *pachycephala* Grun.															
D. vulgaris Bory						r	0.62	0.23				vr			
D. vulgaris v. *brevis* Grun.	0.08	0.03		vr	0.30			vr			0.28			vr	vr
D. vulgaris v. *linearis* V.H.															
Genus *Fragilaria* Lyngb.	1.14	0.83	34.13	27.87	24.04	30.35	32.97	52.60	26.12	24.78	32.47	27.49	22.72	42.81	44.98
F. brevistriata Grun.	c	c	vr	r	qc			qc			vc			r	
F. brevistriata v. *inflata* (Pant.) Hust.	r				r										

Table 2 (cont.)

MONTH	November 1968														
STATION	FP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
F. breviatriata v. *capitata* Hérib.															
F. capucina Desm.			3.40	5.98	3.29	2.65	7.85	14.24	1.31	3.44	3.54	4.54	1.63	2.02	7.09
F. capucina v. *mesolepta* Rabenh.															
F. capucina v. *lanceolata* Grun.						r	qc	qc							
F. construens (Ehr.) Grun.	vc	vc	r	r	r										
F. construens v. *venter* (Ehr.) Grun.								vr			vc			r	vc
F. construens v. *binodis* (Ehr.) Grun.															
F. construens v. *pumila* Grun.	vc	c												vr	
F. construens v. *minuta* Temp. and Perag.															
F. crotonensis Kitt.															
F. intermedia Grun.	0.02	0.30	30.54	21.61	19.51	27.70	26.00	38.14	24.75	21.30	26.55	19.20	20.82	39.69	32.85
F. intermedia v. *fallax* Grun.	r	r		r	r	vr	r	r				qc	r		c
F. leptostauron (Ehr.) Hust.															
F. leptostauron v. *dubia* (Grun.) Hust.					r			vr		r					
F. leptostauron v. *fossilis* (Pant.) Reháková					vr										
F. lapponica Grun.		vr			vr										
F. pinnata Ehr.	vr	vr													
F. pinnata v. *lancettula* (Schum.) Hust.	c	c	vr	vr	qc		vr	vr			c	c		r	vc
F. pinnata v. *intercedens* (Grun.) Hust.	c	vc		r	vc			vr			c			vr	
F. vaucheriae v. *capitellata* (Grun.) Patr.															
F. vaucheriae v. *fallax* Grun.															
F. vaucheriae v. *truncata* Grev.															

Table 2 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
F. crotonensis varieties															
Fragilaria sp. #6															
Fragilaria sp. #9															
Fragilaria sp. #11															
Gomphonema acuminatum v. *pusillum* Grun.										vr					
G. acuminatum v. *coronata* (Ehr.) Rabh.															
G. abbreviatum v. *inflata* Hust.															
G. angustatum (Kütz.) Rabh.	qe	r			r			vr			qe				
G. angustatum v. *producta* Grun.	qe				vr										
G. bohemicum Reich. & Fricke														vr	
G. constrictum Ehr.	vr													vr	
G. clevei Fricke															
G. constrictum v. *capitata* (Ehr.) Cleve															
G. grovei M. Schm.															
G. gracile Ehr.															
G. gracile v. *cymbelloides* Grun.															
G. intricatum Kütz.															
G. intricatum v. *dichotomum* (Kütz.) Grun.															
G. lanceolatum Ehr.	vr														
G. longiceps v. *subclavata* Grun.															
G. lanceolatum v. *insignis* (Greg.) Cleve											vr				
G. olivaceum (Lyngb.) Kütz.	vc	vc	vr	r	vc				vr	vr	vc			qe	vr
G. olivaceum v. *minutissima* Hust.															
G. olivaceum v. *calcarea* Cleve															

Table 2 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
G. parvulum (Kütz.) Kütz.															
G. subclavatum Grun.															
G. sphaerophorum Ehr.															
G. tergestinum (Grun.) Fricke															
Gomphonema sp. #2															
Gomphonema sp. #3															
Gomphonema sp. #10															
Gomphonema spp.															
Genus *Navicula* Bory	1.63	1.71	0.23	0.28	0.64	0.18	0.04	0.04	0.12	vr	0.35	0.04	0.01	0.17	0.15
N. anglica Ralfs															
N. anglica v. *subsalsa* (Grun.) Cleve															
N. anglica v. *signata* Hust.				r					vr	vr	qc				
N. aurora Sov.															
N. bacillum Ehr.															
N. capitata Ehr.	r	r		vr	vr			vr			vr	vr			vr
N. capitata v. *hungarica* (Grun.) Ross		vr		vr							r				
N. capitata v. *luneburgensis* (Grun.) Patr.	vr	r	vr	r	vr	r	r	qc			vc		vr	vr	
N. cuspidata Kütz.											vr				
N. cuspa Hohn															
N. cincta (Ehr.) Ralfs															
N. clementis Grun.															
N. clementis v. *linearis* Bander															
N. clementis v. *quadristigmata* Mang.															
N. costulata Grun.				vr	vr	c	qc	qc			qc			vr	vr
N. concenta v. *biceps* (Arn.) V.H.															

Table 2 (cont.)

MONTH	November 1968														
STATION	FP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
N. confervacea (Kütz.) Grun.															
N. crucicula (W. Sm.) Donk.															
N. cuspidata v. *obtusa* Patr.															
N. canalis Patr.															
N. cryptocephala Kütz.											vr				
N. cryptocephala v. *intermedia* Grun.	ve	ve			e			vr			qe			vr	vr
N. cryptocephala v. *veneta* (Kütz.) Rabh.			vr					r							
N. decussis Øst.	ve	ve	vr	r	ve	r	r	qe	r		ve	vr	vr	ve	qe
N. elginensis (Greg.) Ralfs															
N. elginensis v. *rostrata* (A. Mayer) Patr.															
N. ericaformis Hust.															
N. exigua Greg. ex Grun.															
N. explanata Hust.															
N. gastrum (Ehr.) Kütz.	ve	e		vr	qe					vr	e			vr	vr
N. gastrum v. *signata* Hust.	vr	vr			vr		vr	vr			vr				
N. gregaria Donk.															
N. gastriformis Hust.															
N. grimmei Krasske															
N. gibbosa Meist.															
N. heufleri Grun.															
N. hassiaca Krasske															
N. integra (Wm. Smith) Ralfs		vr			vr										
N. ingenua Hust.															
N. insignita Hust.															
N. imbricata Bock	qe														vr
N. lacustris Greg.															
N. latens Krasske			vr	e	vr	r	r	qe	r		vr			r	
N. lanceolata (Agardh) Kütz.		r			r		vr				vr			vr	

Table 2 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
N. menisculus Schum.															
N. menisculus v. *upsaliensis* Grun.		vr	vr	vr	qc	r	r	vr			c	vr	vr	r	vr
N. mutica v. *tropica* Hust.				vr											
N. mutica v. *cohnii* (Hilse) Grun.	vr										vr			vr	
N. minima Grun.															
N. oblonga (Kütz.) Kütz.	vr		vr												
N. odiosa Wallace	qc														
N. oppugnata Hust.															
N. paludosa Hust.	c	c			c						vr				
N. peristoma Hust.															
N. placentula (Ehr.) Kütz.					vr										
N. placentula v. *rostrata* A. Mayer															
N. platystoma v. *pantocsekii* Wisl. and Kolbe		vr	vr	vr		vr	vr	vr			r			vr	
N. platystoma Ehr.															
N. protracta Grun.															
N. protracta v. *elliptica* Gallik															
N. peregrina (Ehr.) Kütz.															
N. pupula Kütz.	r	vr			vr						vr				vr
N. pupula v. *capitata* Skv. and Meyer															
N. pupula v. *rectangularis* (Greg.) Grun.		vr									vr			vr	
N. pupula v. *mutata* (Krasske) Hust.		vr	vr		r			vr			r			vr	
N. pupula v. *rostrata* Hust.															
N. pygmaea Kütz.															
N. radiosa Kütz.					vr										
N. radiosa v. *parva* Wallace															

Table 2 (cont.)

MONTH	November 1968														
STATION	FP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
N. radiosa v. *tenella* (Bréb.) Grun.															
N. reinhardtii (Grun.) Grun.					r										
N. reinhardtii v. *elliptica* Hérib.															
N. rhynchocephala Kütz.					vr										
N. rhynchocephala v. *germainii* (Wallace) Patr.															
N. rhynchocephala v. *amphiceros* (Kütz.) Grun.															
N. rotunda Hust.															
N. subliniana Patr. ?	vr	vr			vr			vr			r				
N. scutelloides Wm. Smith															
N. schroeteri v. *escambia* Patr.					vr										
N. seminulum Grun.															
N. simplex Krasske	r	vr													
N. stroesei A. Cl.															
N. symmetrica Patr.	vr														
N. tantula Hust.															
N. texana Patr. ?															
N. tripunctata (O.F. Müll.) Bory	vc	vc			r						qe			vr	vr
N. tripunctata v. *cuneata* Lauby															
N. tripunctata v. *schizonemoides* (V.H.) Patr.	vr	vc			r	vr	vr	vr			e			vr	
N. tuscula Ehr.															
N. tuscula fo. *obtusa* Hust.															
N. tuscula fo. *rostrata* Hust.															
N. vanheurckii Patr.															
N. varicostriata Krasske															
N. viridula (Kütz.) Kütz.			vr		r										
N. viridula v. *avenacea* (Bréb.) V.H.															

Table 2 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
N. viridula v. *linearis* Hust.	vr	r			qe						vr				
N. viridula v. *rostellata* (Kütz.) Cleve		vr													
N. vulpina Kütz.															vr
N. wittrockii (Lagerstedt) A. Cl.															
Navicula sp. (*pygmaea* v. *producta*)	r	r			vr						r				
Navicula sp. #8 (*aff. lanceolota*)															
Navicula sp. #18															
Navicula sp. #19															
Navicula sp. #22															
Navicula sp. #23	qe														
Navicula sp. #25														r	
Navicula sp. #27															
Navicula sp. #36															
Navicula sp. #38															
Navicula sp. #40															
Navicula sp. #43															
Navicula sp. #44					vr										
Navicula sp. "A"					vr		vr				r				
Navicula sp.															
Navicula sp.															
Navicula sp.															
Navicula sp.															
Navicula sp.															
Navicula sp.															
Navicula sp.															
Genus *Nitzschia* Hass.	0.63	1.45	2.34	2.64	0.64	1.57	1.04	2.40	0.37	0.34	0.62	0.79	0.27	3.18	2.04
N. acicularis (Kütz.) Wm. Smith															

Table 2 (cont.)

MONTH STATION DEPTH, METERS	November 1968 FP 1	6.6	MP 1	7	9	EP(1) 1	5	9	EP(2) 1	5	9	LAKE 1	10	25	28
N. acuminata (Wm. Smith) Grun.					vr										
N. acuta Hantz.							vr	r							
N. amphibia Grun.	qc	vc	vc	qc	qc			vr		qc	qc		r	qc	qc
N. amphibia v. *fossilis* Grun.															
N. angustata (Wm. Smith) Grun.															
N. angustata v. *acuta* Grun.															
N. apiculata (Greg.) Grun.															
N. bacata Hust.															
N. capitellata Hust.															
N. commutata Grun.															
N. confinis Hust.															
N. denticula Grun.															
N. dissipata (Kütz.) Grun.	qc	qc		qc	r	r	r	qc	qc	qc	qc	qc		qc	qc
N. dissipata v. *media* (Hantz.) Grun.															
N. fonticola Grun.															
N. frustulum (Kütz.) Grun.															
N. frustulum v. *perminuta* Grun.															r
N. frustulum v. *perpusilla* (Rabh.) Grun.	r.				qc	r	r		r		r			qc	
N. hungarica Grun.															
N. holsatica Hust.															
N. interrupta (Reich.) Hust.															
N. lacunensis Hust.															
N. linearis Wm. Smith	r	r			vr		vr								
N. palea (Kütz.) Wm. Smith	r	r			vr						r				
N. parvula Wm. Smith					vr										
N. recta Hantz.							r								
N. romana Grun.															
N. sigmoidea (Nitz.) Wm. Smith					vr							r			
N. sigma (Kütz.) Wm. Smith	r						vr								

Table 2 (cont.)

MONTH	November 1968														
STATION	FP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
N. spiculoides Hust.															
N. sublinearis Hust.															
N. subtilis (Kütz.) Grun.					vr										
N. stagnorum Rabh.															
N. thermalis (Ehr.) Auersv.															r
N. thermalis v. *intermedia* Grun.															
N. thermalis v. *minor* Hilse															
N. tryblionella Hantz.		r													
N. tryblionella v. *debilis* (Arn.) A. Mayer															
N. tryblionella v. *levidensis* (Wm. Smith) Grun.															
N. tryblionella v. *victoriae* Grun.	r	r			vr						r				r
N. woltereckii Hust.	r														
Nitzschia sp. "A"							vr								r
Nitzschia sp. "B"															
Nitzschia sp. #1					r	qe	qe	vc							
Nitzschia sp. #2	r	qe	qe			e	vc	vc			vr		r	qe	qe
Nitzschia sp. #6	r	r													
Nitzschia sp. #7															
Nitzschia sp. #8															
Nitzschia sp. #9															
Nitzschia sp.															
Nitzschia sp.															
Nitzschia sp.															
Nitzschia spp.					r										
Genus *Synedra* Ehr.	0.54	0.34	0.74	0.28	0.56	0.27	0.34	0.11	0.73	0.47	0.06	0.26	0.14	0.46	0.15
S. acus Kütz.	r	r	vr	vr	vr			vr		r	vr	vr		vr	
S. amphicephala Kütz.															

Table 2 (cont.)

MONTH	November 1968														
STATION	FP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
S. capitata Ehr.															
S. delicatissima Wm. Smith								VT							
S. delicatissima v. *angustissima* Grun.							r	VT				VT			
S. decorans Grun.				r			VT							r	r
S. fasciculata (Agardh) Kütz.	VT														
S. filiformis Grun.															
S. filiformis v. *exilis* A.Cl.															
S. minuscula Grun.															
S. ostenfeldii (Krieg.) A.Cl.															
S. parasitica (W. Smith) Hust.															
S. parasitica v. *subconstricta* (Grun.) Hust.	VT	VT			r										
S. pulchella Ralfs	VT														
S. pulchella v. *lanceolata* O'Meara															
S. pulchella v. *lacerata* Hust.															
S. rumpens Kütz.															
S. rumpens v. *fragilarioides* Grun.															
S. tenera Wm. Smith															
S. ulna (Nitz.) Ehr.	e	qe		VT	qe			r	qe	qe	r	r	r	qe	r
S. ulna v. *chaseana* Thomas	r		r	VT	VT	r	r	r	VT	VT	VT	VT	VT	r	r
S. ulna v. *contracta* Østr.	VT	VT						VT							
S. ulna v. *constricta* Venkt.															
S. ulna v. *claviceps* Hust.											VT				

Table 2 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
S. ulna v. *danica* (Kütz.) V.H.			qe	vr		r	r	vr							vr
S. ulna v. *longissima* (Wm. Smith) Brun															
S. ulna v. *subaequalis* (Grun.) V.H.															
S. ulna v. *spathulifera* (Grun.) V.H.	vr														
S. ulna v. *oxyrhynchus* (Kütz.) V.H.	vr														
Synedra sp. (*vaucheriae* v. *fragilarioides*)							vr	e		r				qe	e
Synedra sp. (*capitata* v. *fossilis*)															
Synedra sp. "A"															
Genus *Tabellaria* Ehr.	0.03	0.03	1.13	2.36	0.38	0.72	2.20	1.62	0.99	3.09	0.97	2.97	5.03	2.14	1.45
T. fenestrata (Lyngb.) Kütz.	0.03	0.03	1.13	1.11	0.38	0.72	2.20	1.62	0.99	3.09	0.97	2.97	5.03	2.14	1.45
T. fenestrata v. *geniculata* A.Cl.			vr			r	r	r					vr		
T. flosculosa (Roth) Kütz.				1.25	vr		vr								
Amphiprora ornata Bail.	vr		vr		vr			vr				vr			vr
Amphipleura pellucida (Kütz.) Kütz.							vr								
Anomoeoneis sphaerophora (Ehr.) Pfitz.															
Bacillaria paxillifer (O.F. Müll.) Hendy	vr	vr													

Table 2 (cont.)

MONTH STATION DEPTH, METERS	November 1968 PP 1	 6.6	 MP 1	 7	 9	 EP(1) 1	 5	 9	 EP(2) 1	 5	 9	 LAKE 1	 10	 25	 28
Caloneis amphisbaena (Bory) Cleve					vr										
C. bacillum (Grun.) Cleve															
C. bacillaris v. *thermalis* (Grun.) A.Cl.															
C. bacillum v. *lancettula* (Schulz) Hust.															
C. lewisii Patr.															
C. ventricosa (Ehr.) Meist.															
C. ventricosa v. *truncatula* (Grun.) Meist.			vr	vr							vr				
C. ventricosa v. *subundulata* (Grun.) Patr.															
Cymatopleura elliptica (Bréb. & Godey) Wm. Smith															
C. solea (Bréb. & Godey) Wm. Smith	r			vr									vr		vr
C. solea v. *apiculata* (Wm. Smith) Ralfs				vr			vr	vr			r	vr		r	vr
Denticula tenuis v. *crassula* (Näg.) Hust.															
Diploneis puella (Schum.) Cleve															
D. papula (Schmidt) Cleve ?								vr			vr				
D. subovalis Cleve				vr											
Diploneis sp. #1															
Diploneis sp.															
Diploneis sp.															

Table 2 (cont.)

MONTH	November														
STATION	FP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10.	25	28
Epithemia argus (Ehr.) Kütz.	VF	VF													
E. intermedia Fricke															
E. sorex Kütz.															
E. turgida (Ehr.) Kütz.					VF						VF				
E. zebra (Ehr.) Kütz.											VF				
E. zebra v. *porcellus* (Kütz.) Grun.															
Epithemia sp.	VF														
Eunotia arcus Ehr.															
E. arcus v. *bidens* Grun.															
E. curvata (Kütz.) Lagerst.															
E. formica Ehr.							VF								
E. pectinalis v. *minor* (Kütz.) Rabh.															
E. pectinalis v. *ventricosa* Grun.															
E. vanheurckii Patr.															
Eunotia sp.															
Frustulia rhomboides v. *amphipleuroides* (Grun.) Cleve															
F. vulgaris (Thw.) DeToni															
F. weinholdii Hust.															
Frustulia sp.															
Gyrosigma acuminatum (Kütz.) Rabh.															
G. attenuatum (Kütz.) Rabh.															
G. spencerii v. *curvula* (Grun.) Reim.															
G. scalproides (Rabh.) Cleve	VF				VF						r				
G. wormleyi (Sulliv.) Boyer															
Gyrosigma sp.												VF			

Table 2 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
Hantzschia amphioxys (Ehr.) Grun.															
Mastogloia grevillei W. Smith															
M. smithii Thw.															
M. smithii v. *lacustris* Grun.					vr										
Meridion circulare (Grev.) Agardh	vr	vr				vr									
M. circulare v. *constrictum* (Ralfs) V.H.															
Neidium affine (Ehr.) Pfitz.															
N. binodis (Ehr.) Hust.															
N. dubium (Ehr.) Cleve	r	r			r						vr			vr	vr
N. dubium fo. *constrictum* Hust.	vr														
N. iridis (Ehr.) Cleve															
N. iridis v. *amphigomphus* (Ehr.) A. Mayer															
N. productum (Wm. Smith) Cleve															
N. temperei Rein.															
Neidium sp. #3															
Neidium sp.															
Costropia zachariasi (Reich.) Stoermer															
C. zachariasi v. *undulata* (Schulz) Stoermer															
Opephora martyi Hérib.	vr	40									r			vr	
Pinnularia abaujensis (Pant.) Ross															
P. acrosphaeria Wm. Smith															
P. biceps Greg.															
P. biceps fo. *petersenii* Ross															

Table 2 (cont.)

MONTH	November 1968														
STATION	FP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
P. brebissonii (Kütz.) Rabh.															
P. borealis Ehr.															
P. burkii Patr.															
P. intermedia (Lagerst.) Cleve															
P. leptosoma (Grun.) Cleve															
P. obscura Krasske															
P. rupestris Hantz.															
Pinnularia sp.															
Rhoicosphenia curvata (Kütz.) Grun.	vc	vc			r						vc			cc	vr
Rhopalodia gibba (Ehr.) O. Müll.															
Rh. gibberula (Ehr.) O. Müll.															
Stauroneis acutiuscula Perag. & Hérib.				vr	r		vr				r				
S. anceps fo. *gracilis* Rabh.															
S. anceps fo. *linearis* (Ehr.) Hust.															
S. pheonicenteron (Nitz.) Ehr.	vr														
S. phoenicenteron fo. *gracilis* (Ehr.) Hust.															
S. kriegeri Patr.															
S. smithii Grun.															
Stauroneis sp.															
Surirella angustata Kütz.	vr			vr			c	vr			vr			vr	r
S. linearis Wm. Smith															
S. linearis v. *constricta* (Ehr.) Grun.															
S. ovata Kütz.															
S. ovata v. *pinnata* (Wm. Smith) Hust.															
S. robusta v. *splendida* (Ehr.) V.H.															
Surirella sp.						vr									vr
Tropidoneis lepidoptera v. *proboscidea* Cleve															

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
DIATOMS	59.27	71.12	89.15	85.60	93.10	89.09	84.72	83.42	96.09	92.44	83.58	87.95	81.95	86.07	77.97	78.43	86.91	87.38
CENTRALES	39.16	54.65	57.74	57.91	74.20	59.26	67.09	63.90	81.47	78.48	58.81	56.73	43.73	48.54	37.81	41.55	56.10	60.95
Cyclotella atomus Hust.																		
C. bodanica Eulenst.																		
C. comta (Ehr.) Kütz.	0.26		0.38	0.35		0.23	0.38	1.07	0.16		0.50	0.74	0.79	0.06			0.11	0.08
C. comta v. *oligactis* (Ehr.) Grun.																		
C. comensis Grun.																		
C. cryptica Reimann, Lewin & Guillard			0.16		0.08													
C. kützingiana Thw.	0.26		0.16	0.15	0.32	0.46				1.13	0.65	0.87	0.65	0.06	0.43	0.25	0.74	
C. kützingiana v. *radiosa* Fricke																		
C. meneghiniana Kütz.	7.29	2.00	0.16	2.28	0.32	0.54	0.75	1.40	11.52	7.31	6.10	4.55	1.31	1.74	0.86	0.49	0.49	2.60
C. meneghiniana v. *plana* Fricke	18.35	14.90	2.28	1.60	0.74	0.76			23.05	13.00	19.27	17.54	6.03	2.03	2.73	2.20	0.50	1.06
C. michiganiana Skv.	0.27	0.16	0.38	1.60	0.37	1.62			1.18		0.16	0.43	0.11			0.73		
C. ocellata Pant.			2.81	2.28	6.15	4.17	5.26	5.40			0.98	0.87	2.10	0.68	1.73	2.45	2.22	1.36
C. operculata (Agardh.) Kütz.																		
C. pseudostelligera Hust.																		
C. stelligera (Cleve & Grun.) V.H.		0.16	12.12	8.90	7.70	11.82	1.50	3.43				0.43	0.11	1.84	0.43	0.74	1.23	0.61
C. striata (Kütz.) Grun.																		
Cyclotella sp. #3																		
Coscinodiscus subsalsa Juhl.-Dannf.	0.26																	
Coscinodiscus sp.									0.17	0.27	0.50	0.87			0.13			
Melosira granulata (Ehr.) Ralfs	0.55	1.18	0.16	0.19	0.07	0.15	0.40	0.30	2.86	1.90	2.02	1.00	1.20	0.03	0.13	0.25	0.14	0.11
M. granulata v. *angustissima* O. Müll.	1.46	2.76	0.16	0.19	0.07	0.15	0.60	0.40	0.22	0.77	0.30	0.55	0.20	0.06	0.19	0.21		
M. granulata fo. *spiralis* Grun.																		

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	FP		MP		EP		LAKE		FP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
M. islandica O. Müll.			5.20	4.86	4.33	9.96	12.40	6.02			2.10	2.50	5.64	7.49	6.54	7.50	5.80	12.52
M. italica subsp. *subarctica* O. Müll.			1.65	1.50	1.25	2.18	1.18	0.71			0.90	1.00	2.40	3.50	2.80	2.68	2.47	4.25
M. varians Ag.	0.28	0.62		0.23		0.20			0.17	0.58	0.30	0.55	0.19	0.06				0.11
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi		0.41	17.56	21.24	34.24	19.24	22.88	25.54			5.93	6.28	11.41	4.26	10.07	6.86	12.34	11.38
S. astraea (Ehr.) Grun.		0.16	0.16	1.60	0.32	0.23				0.78	0.49	0.34	0.65		0.29	0.25	0.23	0.51
S. binderanus (Kütz.) Kreig.					0.24													
S. hantzschii Grun.				0.34					33.10	36.28	9.55	12.56	3.28	10.26	2.16	7.35	13.60	15.33
S. minutus Grun. ex Cleve & Müll.																		
S. niagarae Ehr.	3.32	2.30	4.21	5.02	2.70	0.93	1.50	3.43	5.91	13.27	4.94	1.30	1.83	6.00	2.88	2.21	9.40	4.10
S. niagarae v. *magnifica* Fricke			vr		r	vr	vr	vr		vr	r	vr	r		qc	vr	vr	
S. subtilis (Van Goor) A. Cl.	1.33	17.76	0.51	0.92	0.37		0.38		0.17	1.02	1.32	1.53	0.32		0.13			1.36
S. tenuis Hust. ex Huber-Pestalozzi	5.35	12.03	0.51			0.23			2.96	2.17	0.17	0.87	0.33	7.06	0.43	1.23	3.34	0.76
S. transilvanicus Pant.			9.13	4.57	14.62	6.26	19.50	15.72			1.65	1.73	4.19	2.23	5.03	6.13	3.47	4.70
Rhizosolenia eriensis H. L. Smith																		
R. gracilis H. L. Smith												0.02		1.15				
Thalassiosira #1																		
Actinoptychus sp.																		
PENNALES	20.11	16.47	31.41	27.69	18.90	29.83	17.63	19.52	14.62	13.96	24.77	31.22	38.22	37.53	40.16	36.88	30.31	26.43
Achnanthes affinis Grun.	r	vr	vr		vr	r	vr	vr	qc	c	c	c	r		r	vr		
A. clevei Grun.																		
A. clevei v. *rostrata* Hust.	vr	vr	r	vr	vr	r			vr	vr	vr		vr		vr		vr	
A. conspicua A. Mayer	vr								vr	vr	r	r	r		vr			vr

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
A. deflexa Reim.																		
A. exigua Grun.	vr			vr		vr			r	r	vr	r	r					
A. exigua v. constricta (Grun.) Hust.									vr	r					vr			
A. flexella (Kütz.) Brun																		
A. hungarica (Grun.) Grun.	vr	vr							vr	vr	qc	r	vr				vr	
A. hauckiana Grun.	r						vr		qc	r	r	vr	r					
A. hauckiana v. rostrata Schulz	r	vr	vr						r	c	qc	r	r		vr			vr
A. lanceolata (Bréb.) Grun.	vc	vr	r	vr					c	c	vc	c	r		vr		vr	vr
A. lanceolata v. apiculata Patr.																		
A. lanceolata v. dubia Grun.	vc	c	vr	r	vr	r	vr	vr	c	vc	vc	e	e	vr	qc		r	r
A. lanceolata v. omissa Reim.																		
A. lanceolata v. elliptica Cleve																		
A. lanceolata v. bimaculata Hust.									vr									
A. lauenburgiana Hust.	vc	qc	r	vr		vr		vr	r	qc	r	r	r		vr	vr	vr	vr
A. linearis (Wm. Smith) Grun.																		
A. lemmermanni Hust.																		
A. lanceolatoides Sov.																		
A. microcephala (Kütz.) Grun.	vr	vr									vr	vr						
A. minutissima Kütz.	r	r				vr												
A. oestrupi (A.Cl.) Hust.			r	vr		vr												
A. pinnata Hust.	r		vr			vr			vr	vr	c	r	r					
A. wellsiae Reim.																		
Achnanthes sp. #1																		
Achnanthes sp. #6																		
Achnanthes sp. #14																		
Achnanthes sp. #15																		
Achnanthes sp. #23									vr									

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Amphora bullatoides Hohn & Hellman										vr								
A. calumetica (Thomas) Perag.																		
A. cruciferoides Stoermer																		
A. hemicycla Stoermer																		
A. huronensis Stoermer																		
A. michiganensis Stoermer															vr			
A. neglecta Stoermer		vr	vr		vr	qe		vr	r							vr		vr
A. normanii Rabh.																		
A. ovalis (Kütz.) Kütz.	r	vr	r	qe	r	vr		vr	r	r	e	e	qe		vr		vr	
A. ovalis v. *constricta* Skv.																		
A. ovalis v. *gracilis* (Ehr.) V.H.	vr	vr	vr						r	e	e	e	qe	vr	vr			r
A. ovalis v. *libyca* (Ehr.) Cleve	qe		qe	vr	vr	vr	vr	vr	vc	vc	vc	e	r					vr
A. ovalis v. *pediculus* (Kütz.) V.H.	e	e	qe	vr		r			vc	vc	vc	e	e		vr		vr	r
A. [illegible] Skv.										r								
A. sibirica Skv. & Meyer		r	vr	vr				vr							vr			
A. subcostulata Stoermer		vr		vr					r	e	qe	qe	r					
A. veneta Kütz.																		
Amphora sp. (*veneta* v. *angularis*)																		
Genus *Asterionella* Hass.	1.76	1.52	2.70	2.85	2.06	1.91	0.98	1.62	0.30	1.51	1.24	0.77	0.94	1.75	0.45	1.27	2.24	0.74
Asterionella bleakeleyi Wm. Smith																		
A. gracillima (Hantz.) Herib.			0.43														0.42	
A. formosa Hass.	1.76	1.52	2.07	2.85	2.06	1.91	0.98	1.62	0.30	1.51	1.05	0.77	0.94	1.75	0.45	1.27	1.82	0.51
A. formosa v. *acaroides* Lemm.			0.20								0.19							0.23

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Cocconeis diminuta Pant.	r	vr	r	r					r	vr	qc	qc	vr	vr	vr			
C. disculus (Schum.) Cleve						vr					vr							
C. fluviatilis Wallace																		
C. placentula Ehr.	r	vr	vr	vr	vr	r			c	c	c	c	c	vr	r	vr	vr	vr
C. placentula v. *euglypta* (Ehr.) Cleve	vr	vr	vr	vr			vr	vr	r	c	c	c	r		r			
C. placentula v. *lineata* (Ehr.) V.H.	qc	vr	vr	vr					r	qc	r	vr	vr					
C. pediculus Ehr.	r	r	vr			vr			qc	vc	c	c	c		vr		vr	
C. rugosa Sov.																		
C. thumensis A. Mayer	r	r	r	vr		vr			r	r	vr	r	r				vr	
Cocconeis sp. #6																		
Cymbella amphicephala Naeg. ex Kütz.	vr																	
C. affinis Kütz.												vr						
C. cuspidata Kütz.													vr					
C. cistula (Ehr.) Kirchn.		vr		vr	vr													
C. cymbiformis (Agardh? Kütz.) V.H.																		
C. [illegible] Grun.																		
C. delicatula Kütz.																		
C. ehrenbergii Kütz.													vr					
C. helvetica Kütz.																		
C. hustedtii Krasske																		
C. lanceolata (Ehr.) Kirchn.																		
C. laevis Naeg.									vr	vr								
C. latens Krasske																		
C. prostrata (Berkeley) Cleve																		
C. reinhardtii Grun.									vr	r	r	vr	vr		vr			
C. leptoceros v. *rostrata* Hust.																		

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	FP		MP		EP		LAKE		FP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
C. sinuata Greg.	r	vr				vr			r	qc	vc	qc	r		vr			
C. subventricosa Choln.																		
C. tumida (Bréb.) V.H.											vr		vr					
C. turgida Greg.																		
C. turgida v. *pseudogracilis* Choln.									c	vc	vc	vr	vr		vr			
C. triangulata (Ehr.) Cleve									vr									
C. turgidula Grun.																		
C. ventricosa Agardh	vc	r			vr	r		vr	r	r	vc	r	vr		vr		vr	r
Cymbella cistula v. #1																		
Cymbella sp. #2																		
Cymbella sp. #6									vr									
Cymbella sp. #18																		
Cymbella sp. #21									vr	vr								
Cymbella spp.																		
Genus *Diatoma* Bory	0.40	0.29	1.22	1.49	0.68	0.99	0.30	0.34	0.26	0.54	0.26	0.65	0.94	2.23	0.10	2.71	2.90	1.36
D. ehrenbergii Kütz.		0.12																
D. tenue Ag.		vr																
D. tenue v. *elongatum* Lyngb.	0.20	vr	1.22	1.49	0.68	0.98	0.30	0.34	0.20	0.34	0.17	0.47	0.94	1.13	0.10	1.45	1.59	0.80
D. tenue v. *pachycephala* Grun.														1.10		1.26	1.32	0.56
D. vulgare Bory	0.20	0.16	r			r			0.06	0.20	0.09	0.18	r		vr			vr
D. vulgare v. *breve* Grun.	vr	vr																
D. vulgare v. *linearis* V.H.																		
Genus *Fragilaria* Lyngb.	2.28	1.19	7.43	4.72	9.06	10.26	4.37	6.71	0.75	0.48	4.70	12.55	15.22	14.41	21.19	10.77	8.73	8.93
F. brevistriata Grun.	r	qc							qc	c	vc	c	c		qc			
F. brevistriata v. *inflata* (Pant.) Hust.	vr		vr	vr		vr			vc	vc	c			qc	qc			

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
F. brevistriata v. *capitata* Hérib.																		
F. capucina Desm.	0.65	0.29	0.48	0.06	1.17	1.30		0.46		0.05	0.33	1.20	1.38	1.27	2.37	0.18	1.18	1.31
F. capucina v. *mesolepta* Rabenh.	r	vr	r	r						qe	qe	vr		vr	vr			vr
F. capucina v. *lanceolata* Grun.	e	e	qe	vr	vc	r				r	r			vr	vr		vr	r
F. construens (Ehr.) Grun.	qe	vr	qe	vr		r		r	e	vc	e	vc	qe					
F. construens v. *venter* (Ehr.) Grun.										r							r	
F. construens v. *binodis* (Ehr.) Grun.	vr					vr			e	e	e	qe	qe					
F. construens v. *pumila* Grun.	r			vr					e	e	qe	vr	r					
F. construens v. *minuta* Temp. and Perag.																		
F. crotonensis Kitt.			6.53	4.37	5.05	7.73	3.47	5.80	0.26	0.03	3.78	9.62	13.04	11.71	r 16.39	10.21	5.77	5.86
F. intermedia Grun.				vr				r	r	qe	vr	vr	vr			vr	qe	r
F. intermedia v. *fallax* Grun.																qe	e	c
F. leptostauron (Ehr.) Hust.									vr	vr						vr		vr
F. leptostauron v. *dubia* (Grun.) Hust.											r	vr	vr					
F. leptostauron v. *fossilis* (Pant.) Peháková									vr									
F. lapponica Grun.																		
F. pinnata Ehr.	r	r			vr	vr			r	qe	vc	e	qe	vc	vc			
F. pinnata v. *lancettula* (Schum.) Hust.	vr					vr			qe	vc	e	r	qe					
F. pinnata v. *intercedens* (Grun.) Hust.											r							
F. vaucheriae v. *capitellata* (Grun.) Patr.		vr	r		vc	vr					qe							
F. vaucheriae v. *fallax* Grun.																		
F. vaucheriae v. *truncata* Grev.	vc	vc	r	qe		qe			e	vc	e	e	qe		qe		vr	qe

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	FP		MP		EP		LAKE		FP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
F. crotonensis																		
Fragilaria sp. #6																		
Fragilaria sp. #11																		
Fragilaria spp.																		
Gomphonema acuminatum v. *pusillum* Grun.																		
G. acuminatum v. *coronata* (Ehr.) Rab.									vr									
G. abbreviatum v. *inflata* Kuet.																		
G. angustatum (Kütz.) Rab.	vr			vr					r	vr	qe	r	r					
G. angustatum v. *producta* Grun.	r	r		vr		vr			r	c	r	r	r					
G. bohemicum Reich. & Fricke	vr									vr	vr							
G. constrictum Ehr.	vr								vr	vr	vr	vr						
G. clevei Fricke											vr	vr						
G. constrictum v. *capitata* (Ehr.) Cleve																		
G. grovei M. Schm.											vr							
G. gracile Ehr.																		
G. gracile v. *cymbelloides* Grun.											vr	vr						
G. intricatum Kütz.										vr	vr							
G. intricatum v. *dichotomum* (Kütz.) Grun.																		
G. lanceolatum Ehr.		r								r	vr							
G. longiceps v. *subclavata* Grun.														vr				
G. lanceolatum v. *insignis* (Greg.) Cleve																		
G. olivaceum (Lyngb.) Kütz.	vc	vc	vc	vc	vr	vc		qe	vc	vc	vc	vc	c	r	=	r	r	c
G. [illegible]																		
G. [illegible] Cleve																		

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
G. parvulum (Kütz.) Kütz.																		
G. subclavatum Grun.										vr								
G. sphaerophorum Ehr.										vr								
G. tergestinum (Grun.) Fricke																		
Gomphonema sp. #2																		
Gomphonema sp. #3																		
Gomphonema sp. #10																		
Gomphonema spp.																		
Genus *Navicula* Bory	5.21	3.21	0.58	2.10	0.24	1.68	0.30	0.34	6.76	4.40	4.43	2.42	1.34	0.10	0.89	vr	0.32	0.76
N. angulica Ralfs																		
N. angulica v. *subsalsa* (Grun.) Cleve																		
N. angulica v. *signata* Hust.						vr												
N. aurora Sov.	vr																	
N. bacillum Ehr.						vr			r	vr	vr							
N. capitata Ehr.	vc	c	r	vr		r			qc	c	qc	r					vr	
N. capitata v. *hungarica* (Grun.) Ross	r		vr			vr		vr		vr			vr		vr		vr	
N. capitata v. *luneburgensis* (Grun.) Patr.	vr	r		vr	r	vr			vr	vr				vr				
N. cuspidata Kütz.									vr	vr								
N. cuspis Hein																		
N. cincta (Ehr.) Ralfs											r							
N. clementis Grun.																		
N. clementis v. *linearis* Brander																		
N. clementis v. *quadristigmata* Mang.																		
N. costulata Grun.			vr															
N. contenta v. *biceps* (Arn.) V.H.																		

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
N. confervacea (Kütz.) Grun.													r					
N. cruciculа (W.Sm.) Donk.																		
N. cuspidata v. *obtusa* Patr.											vr							
N. [illegible] Patr.																		
N. cryptocephala Kütz.	r			vr		vr			vr	r	qc	r		vr		vr		vr
N. cryptocephala v. *intermedia* Grun.	vc	vc	qc	r	vr	r	r	r	vc	vc	vc	qc	r		vr		vr	
N. cryptocephala v. *veneta* (Kütz.) Rabh.	c	c	vr	vr		vr			r	c	r	r	vr		vr			vr
N. decussis Øst.	c	c	qc	vr	vr	r			c	c	vc	qc	c	vr	vr	vr	vr	r
N. elginensis (Greg.) Ralfs																		
N. elginensis v. *rostrata* (A. Mayer) Patr.																		
N. exiguaformis Hust.																		
N. exigua Greg. ex. Grun.																		
N. explanata Hust.										vr								
N. gastrum (Ehr.) Kütz.	vr	r	vr		vr	vr			r	qc	c	r	c		r			
N. gastrum v. *signata* Hust.	vr									vr								
N. gregaria Donk.	vc	vc	qc	vc	r	vc			r	c	r	vr		r	vr		vr	qc
N. gastriformis Hust.											vr							
N. grimmei Krasske										vr			vr					vr
N. [illegible]												vr						
N. heufleri Grun.											vr							
N. hassiaca Krasske						r												
N. integra (Wm. Smith) Ralfs	vr	r							qc	qc	vr	vr	vr				vr	
N. ingenua Hust.									r	vr					vr			
N. insignita Hust.																		
N. imbricata Bock																		
N. lacustris Greg.																		
N. latens Krasske				vr	vr												vr	
N. lanceolata (Agardh) Kütz.	vc	qc				vr			r	c	vr	vr	vr	vr			vr	vr

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	FP		MP		EP		LAKE		FP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
N. menisculus Schum.																		
N. menisculus v. *upsaliensis* Grun.		r							vr	vr			vr				vr	
N. mutica v. *tropica* Hust.									r	vr	vr							vr
N. mutica v. *cohnii* (Hilse) Grun.				vr		vr						vr						
N. minima Grun.																		
N. oblonga (Kütz.) Kütz.										vr	vr							
N. odiosa Wallace																		
N. oppugnata Hust.																		
N. paludosa Hust.	r	r			vr				r	vr	vr	qe	vr			vr		
N. parrtoma Hust.																		
N. placentula (Ehr.) Kütz.										vr			vr					
N. placentula v. *rostrata* A. Meyer										vr	vr	vr	vr					
N. platystoma v. *pantocsekii* Wisl. and Kolbe			vr		vr	vr												
N. platystoma Ehr.																		
N. protracta Grun.	vr									r			vr					
N. protracta v. *elliptica* Gallik									vr									
N. peregrina (Ehr.) Kütz.																		
N. pupula Kütz.	vr	r		vr					r	r	r	r						vr
N. pupula v. *capitata* Skv. and Meyer										vr								
N. pupula v. *rectangularis* (Greg.) Grun.										vr								
N. pupula v. *mutata* (Krasske) Hust.	vr		vr			vr		vr	r	vr								
N. pupula v. *rostrata* Hust.																		
N. pygmaea Kütz.	vr	r									vr							
N. radiosa Kütz.		r								vr	vr							
N. radiosa v. *parva* Wallace									r								vr	

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
N. radiosa v. *tenella* (Bréb.) Grun.	vc	c	vr	vr	vr	vr			qc	c	vr	r	vr	vr			vr	vr
N. reinhardtii (Grun.) Grun.											vr	vr	vr					
N. reinhardtii v. *elliptica* Héric.										vr								
N. rhynchocephala Kütz.										r								
N. rhynchocephala v. *germainii* (Wallace) Patr.																		
N. rhynchocephala v. *amphiceros* (Kütz.) Grun.																		
N. rotunda Hust.																		
N. sabiniana Patr.?																		
N. scutelloides Wm. Smith	r									qc	r	vr	r		vr			
N. schroeteri v. *escambia* Patr.																		
N. seminulum Grun.																		
N. simplex Krasske																		
N. soroseei A. Cl.																		
N. symmetrica Patr.																		
N. tantula Hust.												vr	vr					
N. tenera Patr.?		r					vr											
N. tripunctata (O.F.Müll.) Bory	vc	vc	c	r	vr	vc	r	r	vc	vc	vc	c	c		r		vr	qc
N. tripunctata v. *cuneata* Lauby									vr	r	r	r	r				vr	r
N. tripunctata v. *schizonemoides* (V.H.) Patr.	r								c	c	vc	c	c	vr	qc		vr	r
N. tuscula Ehr.																		
N. tuscula fo. *obtusa* Hust.				vr														
N. tuscula fo. *rostrata* Hust.											vr							
N. vanheurckii Patr.																		
N. variostriata Krasske																		
N. viridula (Kütz.) Kütz.	vr	c		vr		r			c	c	vc	c	c	vr	vr			
N. viridula v. *avenacea* (Bréb.) V.H.										r							vr	

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
N. viridula v. *linearis* Hust.	vc	qc	vr					vr	c	vc	c	c	c					
N. viridula v. *rostellata* (Kütz.) Cleve										vr					vr			
N. vulpina Kütz.											vr		vr					
N. wittrockii (Lagerstedt) A.Cl.											vr	vr						
Navicula sp. (*pygmaea* v. *producta*)										r	vr	vr	vr					
Navicula sp. #8	qc	qc	r	r		r			vr		vr							
Navicula sp. #18																		
Navicula sp. #19																		
Navicula sp. #22																		
Navicula sp. #23		c																
Navicula sp. #25																		
Navicula sp. #27																		
Navicula sp. #36																		
Navicula sp. #38																		
Navicula sp. #40										r	r		vr					
Navicula sp. #43																		
Navicula sp. #44																		
Navicula sp. "A"	vr			vr		vr					vr							
Navicula sp.																		
Navicula sp.																		
Navicula sp.																		
Navicula sp.																		
Navicula sp.																		
Navicula sp.																		
Navicula spp.																		
Genus *Nitzschia* Hass.	3.71	3.21	4.82	5.44	2.85	4.79	3.13	3.30	0.98	1.97	1.99	1.05	3.77	1.60	2.03	2.29	1.72	2.75
N. acicularis (Kütz.) Wm. Smith	vr																	

Table 2 (cont.)

MONTH	March 1969								April 1969										
STATION	PP		MP		EP		LAKE		PP*		MP			EP		LAKE			
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25	-
N. acuminata (Wm. Smith) Grun.					vr	vr						vr	r						
N. acuta Hantz.	vr	r	r	vr	qc	r			vr	r		vr		r	vr		vr	vr	
N. amphibia Grun.	r	r				vr		vr	r	qc	vr	vr	vr	vr	vr			vr	
N. amphibia v. *fossilis* Grun.																			
N. angustata (Wm. Smith) Grun.													vr						
N. angustata v. *acuta* Grun.	vr								r	vc	r								
N. apiculata (Greg.) Grun.	vr										vr								
N. bacata Hust.														r			qc		
N. capitellata Hust.										vr									
N. commutata Grun.	qc	qc									vr								
N. confinis Hust.																			
N. denticula Grun.																			
N. dissipata (Kütz.) Grun.	vc	vc	vc	qc	qc	qc			vr	r	vr	vr		qc	vr	vr	qc	vr	
N. dissipata v. *media* (Hantz.) Grun.	r	r																	
N. fonticola Grun.																			
N. frustulum (Kütz.) Grun.																			
N. frustulum v. *perminuta* Grun.	vr																		
N. frustulum v. *perpusilla* (Rabh.) Grun.																			
N. hungarica Grun.			vr								r		r						
N. holsatica Hust.		vr																	
N. interrupta (Reich.) Hust.													vr						
N. lacunensis Hust.																			
N. linearis Wm. Smith	vc	c						vr	vr	c	r	r							
N. palea (Kütz.) Wm. Smith		vr																	
N. parvula Wm. Smith										vr	vr								
N. recta Hantz.	r	r	r	vr	vr	r				vr				vr			r		
N. romana Grun.																			
N. sigmoidea (Kütz.) Wm. Smith									r	r	r	r	vr		vr				
N. sigma (Kütz.) Wm. Smith																			

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
N. apiculoides Hust.					r	r				vr				vr				
N. sublinearis Hust.																		
N. subtilis (Kütz.) Grun.																		
N. stagnorum Rabh.			vr															
N. thermalis (Ehr.) Auersw.								vr										
N. thermalis v. *intermedia* Grun.																		
N. thermalis v. *minor* Hilse																		
N. tryblionella Hantz.	vr									vr	vr							
N. tryblionella v. *debilis* (Arn.) A. Mayer																		
N. tryblionella v. *levidensis* (Wm. Smith) Grun.	vr	vr								vr	r							
N. tryblionella v. *victoriae* Grun.																		
N. woltereckii Hust.											vr		vr					
Nitzschia sp. "A"																		
Nitzschia sp. "B"																		
Nitzschia sp. #1			r	r	qc	c	qc	c			vr	vr	vr	vr	vr		vr	qc
Nitzschia sp. #2	r	vr	vc	vc	vc	vc	c	vc	vc	vc	vc	vc	vc	vc	vc	vc	vc	vr
Nitzschia sp. #6	c	c	r	r	vr	r				r		vr	vr	qc	vr			vr
Nitzschia sp. #7																		
Nitzschia sp. #8																		
Nitzschia sp. #9																		
Nitzschia sp.																		
Nitzschia sp.																		
Nitzschia sp.																		
Nitzschia spp.																		
Genus *Synedra* Ehr.	0.65	1.19	8.87	6.76	1.88	6.01	5.24	4.33	1.99	2.23	5.11	5.47	6.80	10.24	6.98	10.63	10.07	7.71
S. acus Kütz.	vr	vr	c	r	r	vr	r	r	vr	r	vr		vr	vr				
S. amphicephala Kütz.																		

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	FP		MP		EP		LAKE		FP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
S. capitata Ehr.									vr		vr							
S. delicatissima Wm. Smith	vr	vr												vr	vr			
S. delicatissima v. *angustissima* Grun.			c	r	vc	vc	vr	c		r	vc	c	c	vc	c	vc	vc	qc
S. demerarae Grun.									vr	vr	r	vr	r	r	qc	r	vr	
S. fasciculata (Agardh) Kütz.	vr	vr		vr		vr			vr	r	vr							
S. filiformis Grun.											c	c	c	vc	c	qc	vc	c
S. filiformis v. *exilis* A. Cl.																		
S. minuscula Grun.																		
S. ostenfeldii (Krieg.) A. Cl.				vr	c	c	vr	r			vr	vr	qc	vc	qc	c	vc	c
S. parasitica (W. Smith) Hust.		vr							vr	vr	r							
S. parasitica v. *subconstricta* (Grun.) Hust.		vr							vr	r	vr		qc		vr			
S. pulchella Ralfs	vr	vr		vr						vr		vr						vr
S. pulchella v. *lanceolata* O'Meara		vr																
S. pulchella v. *lacerata* Hust.																		
S. rumpens Kütz.																		vr
S. rumpens v. *fragilarioides* Grun.										r								
S. tenera Wm. Smith															vr			
S. ulna (Nitz.) Ehr.	vc	vc		r	r	c		qc	vc	vc	vc	vc	qc	c	c	c	vc	vc
S. ulna v. *chaseana* Thomas			vc	vc	vc	vc	vc	vc			vc	vc	c	vc	vc	vc	vc	vc
S. ulna v. *contracta* Østr.	r	r	vr	vr						vr		vr	vr		vr		vr	
S. ulna v. *constricta* Venkt.	r	r							vr		vr	vr	vr				vr	
S. ulna v. *claviceps* Hust.												r	qc					vr

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
S. ulna v. danica (Kütz.) V.H.	qc	qc	qc	qc	vc	vc	c	c	vr	r	vc	vc	vc	vc	vc	vc	c	vc
S. ulna v. longissima (W. Smith) Brun																vr		
S. ulna v. subaequalis (Grun.) V.H.																		
S. ulna v. spathulifera (Grun.) V.H.	vr	vr							vr	r	vr		vr				vr	vr
S. ulna v. oxyrhynchus (Kütz.) V.H.										vr							r	
Synedra sp. (vaucheriae v. fragilarioides)	vr		vc	vc	vc	vc	c	c		r	vc	vc	vc	c	vc	qc	c	vc
Synedra sp. (capitata v. fossilis)									vr	vr	vr							
Synedra sp. "A"																		
Genus *Tabellaria* Ehr.	0.26	0.08	4.63	1.63	2.01	2.87	2.82	2.65		0.02	4.89	5.94	9.30	6.94	7.36	8.70	4.40	3.35
T. fenestrata (Lyngb.) Kütz.	0.26	0.08	4.63	1.68	2.01	2.87	2.82	2.65		0.02	4.89	5.81	9.30	6.94	7.36	8.70	4.19	3.35
T. fenestrata v. geniculata A.Cl.																		
T. flocculosa (Roth) Kütz.												0.13					0.21	
Amphiprora ornata Bail.					vr		vr			vr				vr				
Amphipleura pellucida (Kütz.) Kütz.			vr		vr	r	vr	vr				vr		vr	vr	vr	vr	
Anomoeoneis sphaerophora (Ehr.) Pfitz.																		
Bacillaria paxillifer (O.F.Müll.) Hendy	vr	r		vr					r	c	qc	r	r					

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Caloneis amphisbaena (Bory) Cleve	vr	vr				vr			r	c	r	vr						
C. bacillum (Grun.) Cleve																		
C. bacillaris v. *thermalis* (Grun.) A.Cl.																		
C. bacillum v. *lancettula* (Schulz) Hust.											vr							
C. lewisii Patr.													vr					
C. ventricosa (Ehr.) Meist.																		
C. ventricosa v. *truncatula* (Grun.) Meist.																		
C. ventricosa v. *subundulata* (Grun.) Patr.																		
Cymatopleura elliptica (Bréb. and Godey) Wm. Smith										vr								
C. solea (Bréb. and Godey) Wm. Smith		vr								r	co	r	r					vr
C. solea v. *apiculata* (Wm. Smith) Ralfs	vr		vr		vr	vr		vr	r	vr	r		r	co	r		vr	
Denticula tenuis v. *crassula* (Naeg.) Hust.																		
Diploneis puella (Schum.) Cleve																		
D. papula (Schmidt) Cleve?																		
D. subovalis Cleve																		
Diploneis sp. #1																		
Diploneis sp.																		
Diploneis sp.																		

Table 8 (cont.)

MONTH	March 1969								April 1969									
STATION	FP		MP		EP		LAKE		FP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.8	1	19	1	6.6	1	6	14.5	1	19.7	1	14	25
Epithemia argus (Ehr.) Kütz.																		
E. intermedia Fricke											vr							
E. sorex Kütz.																		
E. turgida (Ehr.) Kütz.								vr			vr							
E. zebra (Ehr.) Kütz.										vr								
E. zebra v. *porcellus* (Kütz.) Grun.																		
Epithemia sp.																		
Eunotia arcus Ehr.		vr																
E. arcus v. *bidens* Grun.																		
E. curvata (Kütz.) Lagerst.						vr				vr	vr							
E. formica Ehr.																		
E. pectinalis v. *minor* (Kütz.) Rabh.																		
E. pectinalis v. *ventricosa* Grun.																		
E. vanheurckii Patr.																		
Eunotia sp.																		
Frustulia rhomboides v. *amphipleuroides* (Grun.) Cleve																		
F. vulgaris (Thw.) De Toni																		
F. weinholdii Hust.									vr	vr			r					
Frustulia sp.																		
Gyrosigma acuminatum (Kütz.) Rabh.																		
G. attenuatum (Kütz.) Rabh.																		
G. spencerii v. *curvula* (Grun.) Rein.											vr	vr	vr		vr			
G. scalproides (Rabh.) Cleve						vr												
G. wormleyi (Sulliv.) Boyer											vr							
Gyrosigma sp.										vr		vr						

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	FP		MP		EP		LAKE		FP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Nitzschia amphioxys (Ehr.) Grun.																		
Mastogloia grevillei W. Smith																		
M. smithii Thw.												vr						
M. smithii v. *lacustris* Grun.										r								
Meridion circulare (Grev.) Agardh	qc	vc			vr	r			r	r	vr	vr						vr
M. circulare v. *constrictum* (Ralfs) V.H.	r	c																
Neidium affine (Ehr.) Pfitz.																		
N. binode (Ehr.) Hust.																		
N. dubium (Ehr.) Cleve	r	vr	vr	vr		vr				r	vr							
N. dubium fo. *constrictum* Hust.		vr								vr								vr
N. iridis (Ehr.) Cleve										vr								
N. iridis v. *amphigomphus* (Ehr.) A. Mayer																		
N. productum (Wm. Smith) Cleve																		
N. temperei Reim.																		
Neidium sp. #3																		
Neidium sp.																		
Oestrupia zachariasi (Reich) Stoermer																		
O. zachariasi v. *undulata* (Schulz) Stoermer														vr				
Opephora martyi Hérib.	vr		r						r	c	c	vr	r	vr				
Pinnularia abaujensis (Pant.) Ross																		
P. acrosphaeria Wm. Smith																		
P. biceps Greg.									vr	vr								
P. biceps fo. *petersenii* Ross																		

Table 2 (cont.)

MONTH	March 1969								April 1969									
STATION	FP		MP		EP		LAKE		FP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	29
P. krebiesonii (Kütz.) Rabh.																		
P. borealis Ehr.									r	r	vr		vr					
P. burkii Patr.																		
P. intermedia (Lagerst.) Cleve																		
P. leptosoma (Grun.) Cleve									vr	vr	vr							
P. obscura Krasske										vr								
P. rupestris Hantz																		
Pinnularia sp.																		
Rhoicosphenia curvata (Kütz.) Grun.	c	qc	vr	vr		qc			c	c	c	qc	c	vr	r			vr
Rhopalodia gibba (Ehr.) O. Müll.												vr	r	vr				
Ph. gibberula (Ehr.) O. Müll.																		
Stauroneis acutiuscula Perag. and Hérib.																		
S. anceps fo. *gracilis* Rabh.	vr																	
S. anceps fo. *linearis* (Ehr.) Hust.																		
S. phoenicenteron (Nitz.) Ehr.																		
S. phoenicenteron fo. *gracilis* (Ehr.) Hust.										vr								
S. kriegeri Patr.																		
S. smithii Grun.													vr					
Stauroneis sp.																		
Surirella angustata Kütz.			qc	vr	qc	r		vr		vr	vr		vr	qc		vr	c	r
S. linearis Wm. Smith																		
S. linearis v. *constricta* (Ehr.) Grun.																		
S. ovata Kütz.	vr	qc		vr	vr	vr			vr	r	vr	vr	r					r
S. ovata v. *pinnata* (Wm. Smith) Hust.	vr	c		vr		vr			vr					r				vr
S. robusta v. *spendida* (Ehr.) V.H.																		
Surirella sp.																		
Tropidoneis lepidoptera v. *proboscidea* Cleve											vr	vr	vr					

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
DIATOMS	80.52	86.73	85.18	62.80	65.15	68.96	54.86	74.79	69.41	75.75	59.84
CENTRALES	68.11	68.40	62.32	43.97	30.73	43.02	27.77	39.99	28.53	36.28	13.97
Cyclotella atomus Hust.											
C. bodanica Eulenst.											
C. comta (Ehr.) Kütz.	2.08	0.76	0.14	0.17	0.07	0.67			0.06	0.11	0.11
C. comta v. *oligactis* (Ehr.) Grun.											
C. comensis Grun.											
C. cryptica Levin, Reimann & Guillard											
C. kützingiana Thw.	0.70	0.31		0.52			0.76	0.54	0.06	0.42	0.20
C. kützingiana v. *radiosa* Fricke											
C. meneghiniana Kütz.	9.27	13.63	4.44	1.69	0.07	0.54	0.08	0.17	0.06	0.25	0.05
C. meneghiniana v. *plana* Fricke	26.47	12.12	5.75	9.83	2.30	12.00	5.50	1.67	0.77	1.68	1.98
C. michiganiana Skv.									0.06		
C. ocellata Pant.			0.12	0.76	0.34	0.51	0.60	0.67	0.58	1.77	0.25
C. operculata (Agardh) Kütz.											
C. pseudostelligera Hust.			2.35	0.35		0.13	0.08	0.12	1.35		0.11
C. stelligera (Cleve & Grun.) V.H.	0.20	0.46	1.31	0.17	0.22	vr	vr	vr	0.63	0.25	0.05
C. striata (Kütz.) Grun.											
Cyclotella sp. #3											
Coscinodiscus subsalsa Juhl.-Dannf.	0.30										
Coscinodiscus sp.											
Melosira granulata (Ehr.) Ralfs	1.01	2.22	1.29	4.21	4.31	2.41	0.75	3.75	1.40	1.67	1.20
M. granulata v. *angustissima* O. Müll.	2.94	3.90	2.31	3.27	3.10	1.20	0.70	1.69	0.50	0.51	0.37
M. granulata fo. *spiralis* Grun.			3.91			0.21		1.31	0.53		0.40

Table 2 (cont.)

MONTH STATION DEPTH, METERS	May 1969 PP 1	 6.6	 MP 1	 5	 13	 EP 1	 5	 16	 LAKE 1	 10	 25
M. islandica O. Müll.	0.06		0.12	0.90	1.05	0.67	0.73	1.15	1.30	1.55	1.10
M. italica subsp. *subarctica* O. Müll.			0.20	0.70	0.75	0.60	0.56	1.10	0.73	1.58	0.70
M. varians Ag.		1.70	2.12	0.59	0.14	0.63	0.24	0.17			
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	0.76	0.76	0.24	3.22	2.80	3.24	1.98	5.14	1.16	4.30	1.44
S. astraea (Ehr.) Grun.	0.75	0.46	0.12	0.76	0.22	0.67	0.34	0.24		0.11	0.05
S. binderanus (Kütz.) Krieg.			9.00	0.34	6.95	1.33	3.63	10.69	4.14	3.98	2.58
S. hantzschii Grun.	9.49	2.47	10.06	12.13	3.71	13.74	8.15	7.15	6.03	9.42	1.40
S. minutus Grun. ex Cleve & Möll.	4.11	1.69	0.36	0.52	2.91	2.02	1.37	1.34	1.16	1.10	0.32
S. niagarae Ehr.	r	vr	vr	r	vr	r		r	vr	vr	
S. niagarae v. *magnifica* Fricke											
S. subtilis (Van Goor) A. Cl.	5.10	20.45	9.28	1.07	0.34	0.67	1.13	0.33	0.58	0.42	0.05
S. tenuis Hust. ex Huber-Pestalozzi	4.54	7.39	7.84	0.70	1.31	0.67	0.51	0.60	0.43	1.01	0.50
S. transilvanicus Pant.			0.66	1.54	0.07	0.34	0.43	0.67	0.29	1.43	0.75
Rhizosolenia eriensis H.L. Smith			0.35				0.10	0.64	2.53	1.91	0.07
R. gracilis H.L. Smith			0.64				0.28	0.82	4.00	2.78	0.18
Thalassiosira #1					vr	vr					
Actinoptychus sp.					vr	vr					
PENNALES	12.41	18.33	22.56	18.83	34.42	25.94	27.09	34.80	40.88	39.47	45.87
Achnanthes affinis Grun.											
A. clevei Grun.	vc	c		qc	qc	c	vr	vr	vr		
A. clevei v. *rostrata* Hust.	vr								vr		
A. conspicua A. Mayer	vr	vr	vr	r	r	r		vr		vr	

Table 2 (cont.)

MONTH	May 1969										
STATION	FP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
A. deflexa Reim.											
A. exigua Grun.	r	qc	vr	qc		r					
A. exigua v. *constricta* (Grun.) Hust.		vr				vr					
A. flexella (Kütz.) Brun.											
A. hungarica (Grun.) Grun.	qc	vr	vr		r	vr					
A. hauckiana Grun.				r							
A. hauckiana v. *rostrata* Schulz	c	r		r	vr	qc					vr
A. lanceolata (Brébisson) Grun.	vc	c	qc	c	r	c	qc	r			
A. lanceolata v. *apiculata* Patr.											
A. lanceolata v. *dubia* Grun.	vc	vc	c	vc	c	c	r	vr		vr	
A. lanceolata v. *ominosa* Reim.	vr	vr			r						
A. lanceolata v. *elliptica* Cleve			vr	vr	vr	vr					
A. lanceolata v. *bimaculata* Hust.											
A. lauenburgiana Hust.	qc	r	r	qc	vr	r			vr	vr	
A. linearis (Wm. Smith) Grun.					vr						
A. lemmermanni Hust.											
A. lanceolatoides Sov.											
A. microcephala (Kütz.) Grun.									vr		
A. minutissima Kütz.		r	r			vr					
A. ostrupi (A.Cl.) Hust.											
A. pinnata Hust.	r										
A. wellsiae Reim.											
Achnanthes sp. #1											
Achnanthes sp. #6											
Achnanthes sp. #14											
Achnanthes sp. #15											
Achnanthes sp. #23											

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
Amphora bullatoides Hohn & Hellerman											
A. calumetica (Thomas) Perag.											
A. cruciferoides Stoermer											
A. hemicycla Stoermer											
A. huronensis Stoermer			vr								
A. michiganensis Stoermer											
A. neglecta Stoermer				vr	r	vr	vr	vr	r		r
A. normanii Rabh.											
A. ovalis (Kütz.) Kütz.	ve	ve	r	qe	r	r					
A. ovalis v. *constricta* Skv.											
A. ovalis v. *gracilis* (Ehr.) V.H.	qe	r	r	qe	r						
A. ovalis v. *libyca* (Ehr.) Cleve	qe		r	vr		vr		vr	vr		
A. ovalis v. *pediculus* (Kütz.) V.H.	ve	r	qe	c	e	e	r	vr			vr
A. rotunda Skv.											
A. siberica Skv. & Meyer				r		vr		vr			
A. subcostulata Stoermer	e	qe	r	r	r						
A. veneta Kütz.											
Amphora sp. (*veneta* v. *angularis*)											
Genus *Asterionella* Hass.	3.86	5.27	2.03	2.10	0.67	3.28	1.00	1.16	1.23	2.93	1.50
Asterionella bleakeleyi Wm. Smith	1.38	0.88		0.52		0.32		0.08	0.17	1.59	
A. gracillima (Hantz.) Hérib.	0.12	1.27	0.45						0.35	0.35	0.13
A. formosa Hass.	2.36	3.12	1.58	0.67	0.67	2.96	1.00	1.08	0.71	0.99	1.37
A. formosa v. *acaroides* Lemm.				0.91							

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	85
Cocconeis diminuta Pant.	r	vr	r	qc	vr	r					vr
C. disculus (Schum.) Cleve	vr	vr		vr			vr				
C. fluviatilis Wallace											
C. placentula Ehr.	c	vc	c	c	c	vr	vr		vr		
C. placentula v. *euglypta* (Ehr.) Cleve	c	c		c	c	c					
C. placentula v. *lineata* (Ehr.) V.H.	c	vc	vr	r	vr	vr					
C. pediculus Ehr.	c	c	r	r	c	r					
C. rugosa Sov.											
C. thumensis A. Mayer	r	vc		c	qc	r	vr				
Cocconeis sp. #6											
Cymbella amphicephala Näg. ex Kütz.						vr					
C. affinis Kütz.						vr					
C. cuspidata Kütz.						vr					
C. cistula (Ehr.) Kirchn.				vr		vr					
C. cymbiformis (Agardh? Kütz.) V.H.											
C. cesatii Grun.											
C. delicatula Kütz.											
C. ehrenbergii Kütz.											
C. helvetica Kütz.											
C. hustedtii Krasske											
C. lanceolata (Ehr.) Kirchn.											
C. laevis Näg.											
C. latens Krasske											
C. prostrata (Berkeley) Cleve	vr					r					
C. reinhardtii Grun.											
C. leptoceros v. *rostrata* Hust.											

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
C. sinuata Greg.	vr	qc		qc	vr	r					
C. subventricosa Choln.						vc	r				
C. tumida (Bréb.) V.H.	vr	vr		vr							
C. turgida Greg.											
C. turgida v. *pseudogracilis* Choln.											
C. triangulata (Ehr.) Cleve											
C. turgidula Grun.											
C. ventricosa Agardh	vc	c	c	r	c						vr
Cymbella cistula v. #1											
Cymbella sp. #2											
Cymbella sp. #6											
Cymbella sp. #18											
Cymbella sp. #21		vr									
Cymbella spp											
Genus *Diatoma* Bory	0.24	0.57	1.23	0.35	2.25	0.89	2.08	3.44	2.52	2.99	1.66
D. ehrenbergii Kütz.		0.03	vr						r		
D. tenue Ag.	0.08	0.03	0.12	r							vr
D. tenue v. *elongatum* Lyngb.			0.49	0.15	1.15	0.40	1.12	2.55	1.36	1.59	0.89
D. tenue v. *pachycephala* Grun.			0.38	0.08	0.94	0.34	0.96	0.89	1.16	1.40	0.77
D. vulgaris Bory	0.16	0.51	0.24	0.07	0.16	0.15	vr	vr			
D. vulgaris v. *brevis* Grun.						vr					
D. vulgaris v. *linearis* V.H.				vr							
Genus *Fragilaria* Lyngb.	2.25	1.46	4.51	4.72	7.99	7.49	5.89	5.77	10.74	7.19	12.68
F. brevistriata Grun.	c	vc	qc	c	c	c	qc				vr
F. brevistriata v. *inflata* (Pant.) Hust.				r		qc	vr				

Table 2 (cont.)

MONTH STATION DEPTH, METERS	May 1969 PP 1	 6.6	 MP 1	 5	 13	 EP 1	 5	 16	 LAKE 1	 10	 25
F. brevistriata v. *capitata* Hérib.		vr									
F. capucina Desm.	0.40	0.23	1.72	1.15	1.87	2.91	2.40	1.33	7.44	1.94	7.92
F. capucina v. *mesolepta* Rabenh.		r		c	qc	qc	c	qc	qc	c	qc
F. capucina v. *lanceolata* Grun.	r			vr							
F. construens (Ehr.) Grun.	qc	vr	c	c	c	c	vr				r
F. construens v. *venter* (Ehr.) Grun.	vr	vr		r	vr	vr					
F. construens v. *binodis* (Ehr.) Grun.	r	r	c	c	r		vr				
F. construens v. *pumila* Grun.	vr	vr				vr					
F. construens v. *minuta* Temp. and Perag.	vr										
F. crotonensis Kitt.	0.20	0.14	1.60	2.31	4.80	3.86	2.56	3.61	2.33	3.27	4.65
F. intermedia Grun.	vr	qc									
F. intermedia v. *fallax* Grun.			c	c	c						
F. leptostauron (Ehr.) Hust.					vr						
F. leptostauron v. *dubia* (Grun) Hust.	vr			vr		r					
F. leptostauron v. *fossilis* (Pant.) Rehákova	vr		vr								
F. lapponica Grun.				r	vr	vr					
F. pinnata Ehr.	qc	r	vr	qc		r	vr				vr
F. pinnata v. *lancettula* (Schum.) Hust.	qc	r		vr	qc	r	vr				
F. pinnata v. *intercedens* (Grun.) Hust.											
F. vaucheriae v. *capitellata* (Grun.) Patr.		vr	r	vr						vr	
F. vaucheriae v. *fallax* Grun.											
F. vaucheriae v. *truncata* Grev.	c	qc	c	qc	c	qc r					

Table 2 (cont.)

MONTH	May 1969										
STATION	FP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
F. crotonensis varieties											
Fragilaria sp. #6	ve	ve	e	qe	qe	qc	r			r	vr
Fragilaria sp. #9											
Fragilaria sp. #11											
Gomphonema acuminatum v. *pusillum* Grun.											
G. acuminatum v. *coronata* (Ehr.) Rabh.											
G. abbreviatum v. *inflata* Hust.	vr										
G. angustatum (Kütz.) Rabh.	e	qc	r	r	r	e	vr				
G. angustatum v. *producta* Grun.	vr	vr	r	r	vr						
G. bohemicum Reich. & Fricke											
G. constrictum Ehr.											
G. clevei Fricke		r		vr							
G. constrictum v. *capitata* (Ehr.) Cleve				vr							
G. grovei M. Schm.											
G. gracile Ehr.				vr	vr	vr					
G. gracile v. *cymbelloides* Grun.											
G. intricatum Kütz.				vr		vr					
G. intricatum v. *dichotomum* (Kütz.) Grun.											
G. lanceolatum Ehr.											
G. longiceps v. *subclavata* Grun.											
G. lanceolatum v. *insignis* (Greg.) Cleve											
G. olivaceum (Lyngb.) Kütz.	ve	ve	ve	ve	e	ve	e	r		r	
G. olivaceum v. *minutissima* Hust.											
G. olivaceum v. *calcarea* Cleve											

Table 2 (cont.)

MONTH	May 1969										
STATION	FP			MP			EP			LAKE	
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
G. parvulum (Kütz.) Kütz.											
G. subclavatum Grun.											
G. sphaerophorum Ehr.				VF							
G. tergestinum (Grun.) Fricke											
Gomphonema sp. #2											
Gomphonema sp. #3											
Gomphonema sp. #10		VF									
Gomphonema spp.											
Genus *Navicula* Bory	2.71	2.84	2.29	0.73	0.82	0.44	0.44	0.12	0.06	0.44	0.05
N. anglica Ralfs						VF					
N. anglica v. *subsalsa* (Grun.) Cleve											
N. anglica v. *signata* Hust.											
N. aurora Sov.											
N. bacillum Ehr.		VF									
N. capitata Ehr.	c	c	cc	VF	F	F	VF				
N. capitata v. *hungarica* (Grun.) Ross	F	VF							VF		
N. capitata v. *luneburgensis* (Grun.) Patr.				VF		VF			VF		F
N. cuspidata Kütz.	VF				VF	VF					
N. cuspa Honn											
N. cincta (Ehr.) Ralfs											
N. clementis Grun.											
N. clementis v. *linearis* Bander											
N. clementis v. *quadri-stigmata* Mang.											
N. costulata Grun.				VF		VF					VF
N. contenta v. *biceps* (Arn.) V.H.											

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
N. confervacea (Kütz.) Grun.				qc	vr	vr					
N. cruciculа (W. Sm.) Donk.											
N. cuspidata v. *obtusa* Patr.											
N. canalis Patr.											
N. cryptocephala Kütz.	c	vc	c			vr			vr		
N. cryptocephala v. *intermedia* Grun.	qc	c	c	vr	vr	qc	vr	vr	vr		
N. cryptocephala v. *veneta* (Kütz.) Rabh.	c	vc	c			r					
N. decussis Øst.	vc	c	c	c	qc	c	r	r			vr
N. elginensis (Greg.) Ralfs		vr	vr	vr	vr						
N. elginensis v. *rostrata* (A. Mayer) Patr.											
N. exiguaformis Hust.											
N. exigua Greg. ex Grun.			vr								
N. explanata Hust.											
N. gastrum (Ehr.) Kütz.	c	r	vr	qc	vr	qc	vr				
N. gastrum v. *signata* Hust.	vr			vr					vr	vr	vr
N. gregaria Donk.	c	vc	vc		r						
N. gastriformis Hust.											
N. grimmei Krasske											
N. globosa Meist.											
N. heufleri Grun.	c	r	qc	vr		r	vr				
N. hassiaca Krasske											
N. integra (Wm. Smith) Ralfs	r	r	vr		vr						
N. ingenua Hust.											
N. insignita Hust.											
N. imbricata Bock											
N. lacustris Greg.											
N. latens Krasske				r	r	r			vr	vr	vr
N. lanceolata (Agardh) Kütz.	c	vc	r	r	r	r	r				

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
N. menisculus Schum.											
N. menisculus v. *upsaliensis* Grun.		r	vr								vr
N. mutica v. *tropica* Hust.	r	vr	vr	vr							
N. mutica v. *cohnii* (Hilse) Grun.	vr	vr		vr							
N. minima Grun.											
N. oblonga (Kütz.) Kütz.	vr					vr					
N. obtusa Wallace											
N. oppugnata Hust.											
N. paludosa Hust.	vr										
N. peratomus Hust.											
N. placentula (Ehr.) Kütz.											
N. placentula v. *rostrata* A. Meyer	r	vr				vr					
N. platystoma v. *pantocsekii* Wisl. and Kolbe											
N. platystoma Ehr.											
N. protracta Grun.				vr	vr						
N. protracta v. *elliptica* Gallik											
N. peregrina (Ehr.) Kütz.											vr
N. pupula Kütz.	qc	r	vr	vr	vr	qc					
N. pupula v. *capitata* Skv. and Meyer		vr									
N. pupula v. *rectangularis* (Greg.) Grun.	vr				vr	vr		vr			
N. pupula v. *mutata* (Krasske) Hust.			vr	vr							
N. pupula v. *rostrata* Hust.						vr					
N. pygmaea Kütz.			vr								
N. radiosa Kütz.	vr	vr		vr		vr			r		
N. radiosa v. *parva* Wallace											

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
N. radiosa v. *tenella* (Bréb.) Grun.	qe	e									
N. reinhardtii (Grun.) Grun.	r			vr	vr						
N. reinhardtii v. *elliptica* Hérib.											
N. rhynchocephala Kütz.											
N. rhynchocephala v. *germainii* (Wallace) Patr.											
N. rhynchocephala v. *amphiceros* (Kütz.) Grun.											
N. rotunda Hust.											
N. subinflata Patr. ?											
N. scutelloides Wm. Smith	vr			r		vr					
N. schroeteri v. *escambia* Patr.											
N. seminulum Grun.											
N. simplex Krasske											
N. strosei A. Cl.											
N. symmetrica Patr.											
N. tantula Hust.											
N. tenera Patr. ?											
N. tripunctata (O.F. Müll.) Bory	ve	ve	e	e	e	e	qe	vr		vr	
N. tripunctata v. *cuneata* Lauby	qe	qe	r			r	vr				
N. tripunctata v. *schizonemoides* (V.H.) Patr.	ve	ve	e	e	e	ve	qe			vr	
N. tuscula Ehr.											
N. tuscula fo. *obtusa* Hust.											
N. tuscula fo. *rostrata* Hust.											
N. vanheurckii Patr.											
N. variostriata Krasske											
N. viridula (Kütz.) Kütz.	e	qe	r	qe	r	e		vr			vr
N. viridula v. *avenacea* (Bréb.) V.H.	e	vr		vr	vr	r					

Table 2 (cont.)

MONTH STATION DEPTH, METERS	May 1969 PP 1	 6.6	 MP 1	 5	 13	 EP 1	 5	 16	 LAKE 1	 10	 25
N. viridula v. *linearis* Hust.											
N. viridula v. *rostellata* (Kütz.) Cleve	vr	vr									
N. vulpina Kütz.		vr									
N. wittrockii Lagerst.) A. Cl.											
Navicula sp. (*pygmaea* v. *producta*)											
Navicula sp.#3(*aff. lanceolata*)	r		vr	vr	vr	vr					
Navicula sp. #18					vr						
Navicula sp. #19											
Navicula sp. #22											
Navicula sp. #23											
Navicula sp. #25											
Navicula sp. #27						vr					
Navicula sp. #36											
Navicula sp. #38											
Navicula sp. #40											
Navicula sp. #43				vr							
Navicula sp. #44											
Navicula sp. "A"											
Navicula sp.					vr	vr	vr			vr	vr
Navicula sp.									vr		
Navicula sp.											
Navicula sp.											
Navicula sp.											
Navicula sp.											
Navicula sp.											
Genus *Nitzschia* Hass.	1.21	2.91	3.69	3.81	3.82	2.74	3.41	3.94	2.26	2.05	1.50
N. acicularis (Kütz.) Wm. Smith		c	vc	c	c	c	qc	c	qc	r	r

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
N. acuminata (Wm. Smith) Grun.							vr				
N. acuta Hantz.	vr	vr	r		vr				r		
N. amphibia Grun.	qc	c	r	qc	r	qc	r				vr
N. amphibia v. *fossilis* Grun.		vr									
N. angustata (Wm. Smith) Grun.										vr	
N. angustata v. *acuta* Grun.											
N. apiculata (Greg.) Grun.	vr	r									
N. bacata Hust.			vc	e	e	vr	e	e	vc	e	vr
N. capitellata Hust.											
N. commutata Grun.											
N. confinis Hust.											
N. denticula Grun.											
N. dissipata (Kütz.) Grun.	vc	vc	vc	vr	vr				qc		
N. dissipata v. *media* (Hantz.) Grun.	qc	qc									
N. fonticola Grun.		vr	e	vr		vr			vr	vr	
N. frustulum (Kütz.) Grun.											
N. frustulum v. *perminuta* Grun.											
N. frustulum v. *perpusilla* (Rabh.) Grun.											
N. hungarica Grun.	r	vc		vr	e	vr					
N. holsatica Hust.											
N. interrupta (Reich.) Hust.											
N. lacunensis Hust.											
N. linearis Wm. Smith	r	c	r	vr		vr					
N. palea (Kütz.) Wm. Smith		qc	e		vr						
N. parvula Wm. Smith	vr	vr				vr					
N. recta Hantz.	vr	vr	vr		r	r	r		vr	vr	vr
N. romana Grun.											
N. sigmoidea (Nitz.) Wm. Smith	vr	vr	vr	r	vr		vr				
N. sigma (Kütz.) Wm. Smith											

Table 2 (cont.)

MONTH	May 1969										
STATION	PP			MP			EP			LAKE	
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
N. spiculoides Hust.											
N. sublinearis Hust.											
N. subtilis (Kütz.) Grun.											
N. stagnorum Rabh.											
N. thermalis (Ehr.) Auersw.											
N. thermalis v. *intermedia* Grun.											
N. thermalis v. *minor* Hilse											
N. tryblionella Hantz.	r		r	vr	vr						
N. tryblionella v. *debilis* (Arn.) A. Mayer											
N. tryblionella v. *levidensis* (Wm. Smith) Grun.				vr							
N. tryblionella v. *victoriae* Grun.											
N. woltereckii Hust.	vr										
Nitzschia sp. "A"											
Nitzschia sp. "B"											
Nitzschia sp. #1			r	vr	c	c	qc	r	r	c	qc
Nitzschia sp. #2	qc	qc	vc	c	vc	vc	c	c	vc	vc	c
Nitzschia sp. #6		c	vc	r	vr				vr		
Nitzschia sp. #7		vr									
Nitzschia sp. #8		vr									
Nitzschia sp. #9		qc									
Nitzschia sp.											
Nitzschia sp.											
Nitzschia sp.											
Nitzschia spp.											
Genus *Synedra* Ehr.	1.25	3.63	4.07	2.94	6.22	4.62	5.83	7.88	12.55	12.56	8.56
S. acus Kütz.	c	c	r		vr	qc	vr			vr	
S. amphicephala Kütz.			r								

Table 2 (cont.)

MONTH STATION DEPTH, METERS	May 1969 PP 1	 6.6	 MP 1	 5	 13	 EP 1	 5	 16	 LAKE 1	 10	 25
S. capitata Ehr.											
S. delicatissima Wm. Smith	vr	r									
S. delicatissima v.											
angustissima Grun.	qc	vc	vc	qc	vc	c	vc	vc	c	c	c
S. demerarae Grun.	vr			vr	r					vr	
S. fasciculata (Agardh)											
Kütz.	r	qc	qc								
S. filiformis Grun.		r	c	c	c	c	c	c	c	qc	r
S. filiformis v. *exilis*											
A.Cl.		vc	qc	r	r	r	r	r	qc	r	
S. minuscula Grun.			vc						vr		
S. ostenfeldii (Krieg.)											
A.Cl.			r		r		qc	vr	c	qc	r
S. parasitica (W. Smith)											
Hust.	vr	vr		vr			vr				
S. parasitica v. *subconstricta*											
(Grun.) Hust.	vr	vr	vr	r	vr	vr		vr			
S. pulchella Ralfs											
S. pulchella v. *lanceolata*											
O'Meara											
S. pulchella v. *lacerata*											
Hust.											
S. rumpens Kütz.											
S. rumpens v.											
fragilarioides Grun.											
S. tenera Wm. Smith		vr									
S. ulna (Nitz.) Ehr.	c	c	c	qc		c	c	r	r	qc	r
S. ulna v. *chaseana*											
Thomas	vr		vc	vc	vc	vc	c	vc	vc	vc	c
S. ulna v. *contracta* Østr.	r	qc	vr	vr	vr						
S. ulna v. *constricta*											
Venkt.	r	qc	r			vr					
S. ulna v. *claviceps*											
Hust.	c	vr		vr	vr	vr	r				

Table 2 (cont.)

MONTH / STATION / DEPTH, METERS	May 1969 FP 1	FP 6.6	MP 1	MP 5	MP 13	EP 1	EP 5	EP 16	LAKE 1	LAKE 10	LAKE 25
S. ulna v. *danica* (Kütz.) V.H.	r	vr	r	vc	vc	vc	vc	vc	c	c	c
S. ulna v. *longissima* (Wm. Smith) Brun				vr							
S. ulna v. *subaequalis* (Grun.) V.H.											
S. ulna v. *spathulifera* (Grun.) V.H.	c	r		c	c	vr	vr				
S. ulna v. *oxyrhynchus* (Kütz.) V.H.										vr	
Synedra sp. (*vaucheriae* v. *fragilarioides*)			c	c	c	c	qc	c	c	qc	qc
Synedra sp. (*capitata* v. *fossilis*)											
Synedra sp. "A"											
Genus *Tabellaria* Ehr.			3.11	3.64	11.10	5.75	8.01	13.11	10.80	10.79	19.53
T. fenestrata (Lyngb.) Kütz.			3.11	3.50	10.84	5.75	8.01	11.82	10.03	9.68	18.30
T. fenestrata v. *geniculata* A.Cl.											
T. flocculosa (Roth) Kütz.				0.14	0.26			1.29	0.77	1.12	1.23
Amphiprora ornata Bail.				vr	vr	vr					
Amphipleura pellucida (Kütz.) Kütz.			vr		vr		vr	vr	c	qc	vr
Anomoeoneis sphaerophora (Ehr.) Pfitz.											
Bacillaria paxillifer (O.F. Müll.) Hendy	vr	qc	r								

Table 2 (cont.)

MONTH STATION DEPTH, METERS	May 1969 PP 1	 6.6	 MP 1	 5	 13	 EP 1	 5	 16	 LAKE 1	 10	 25
Caloneis amphisbaena (Bory) Cleve	vr		vr	vr							
C. bacillum (Grun.) Cleve		vr									
C. bacillaris v. *thermalis* (Grun.) A.Cl.						vr					
C. bacillum v. *lancettula* (Schulz) Hust.											
C. louisii Patr.											
C. ventricosa (Ehr.) Meist.											
C. ventricosa v. *truncatula* (Grun.)Meist.				vr		r					vr
C. ventricosa v. *subundulata* (Grun.) Patr.											
Cymatopleura elliptica (Bréb. & Godey) Wm. Smith											
C. solea (Bréb. & Godey) Wm. Smith	vr	vr	vr	r	r	vr		r			
C. solea v. *apiculata* (Wm. Smith) Ralfs			vr		vr	r		r			
Denticula tenuis v. *crassula* (Näg.) Hust.									vr		
Diploneis puella (Schum.) Cleve								vr			
D. pupula (Schmidt) Cleve											
D. subovalis Cleve					vr	vr					
Diploneis sp. #1											
Diploneis sp.											
Diploneis sp.											

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
Epithemia argus (Ehr.) Kütz.											
E. intermedia Fricke											
E. sorex Kütz.				vr							
E. turgida (Ehr.) Kütz.											
E. zebra (Ehr.) Kütz.											
E. zebra v. *porcellus* (Kütz.) Grun.											
Epithemia sp.											
Eunotia arcus Ehr.											
E. arcus v. *bidens* Grun.											
E. curvata (Kütz.) Lagerst.	vr	vr				vr					
E. formica Ehr.											
E. pectinalis v. *minor* (Kütz.) Rabh.											
E. pectinalis v. *ventricosa* Grun.											
E. vanheurckii Patr.											
Eunotia sp.											
Frustulia rhomboides v. *amphipleuroides* (Grun.) Cleve											
F. vulgaris (Thw.) DeToni		vr					vr				
F. weinholdii Hust.											
Frustulia sp.											
Gyrosigma acuminatum (Kütz.) Rabh.											
G. attenuatum (Kütz.) Rabh.		vr		vr		vr					vr
G. spencerii v. *curvula* (Grun.) Reim.	vr			vr	vr	vr					
G. scalproides (Rabh.) Cleve											
G. wormleyi (Sulliv.) Boyer		vr									
Gyrosigma sp.											

Table 2 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
Hantzschia amphioxys (Ehr.) Grun.											
Mastogloia grevillei W. Smith											
M. smithii Thw.											
M. smithii v. *lacustris* Grun.											
Meridion circulare (Grev.) Agardh	vr	qc	r	vr							
M. circulare v. *constrictum* (Ralfs) V.H.	vr	vr									
Neidium affine (Ehr.) Pfitz.											
N. binodis (Ehr.) Hust.											
N. dubium (Ehr.) Cleve	vr	vr	vr	r	vr						
N. dubium fo. *constrictum* Hust.	vr										
N. iridis (Ehr.) Cleve											
N. iridis v. *amphigomphus* (Ehr.) A. Mayer						vr					
N. productum (Wm. Smith) Cleve				vr							
N. temperei Reim.											
Neidium sp. #3											
Neidium sp.											
Oestrupia zachariasi (Reich.) Stoermer											
O. zachariasi v. *undulata* (Schulz) Stoermer							vr				
Opephora martyi Hérib.	vr	qc	vr	qc	c	qc	vr				
Pinnularia abaujensis (Pant.) Ross		vr									
P. acrosphaeria Wm. Smith											
P. biceps Greg.											
P. biceps fo. *petersenii* Ross											

Table 2 (cont)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
P. brebissonii (Kütz.) Rabh.											
P. borealis Ehr.	vr	vr		vr		vr	vr				vr
P. burkii Patr.	vr	vr									
P. intermedia (Lagerst.) Cleve											
P. leptosoma (Grun.) Cleve	vr										
P. obscura Krasske											
P. rupestris Hantz.											
Pinnularia sp.											
Rhoicosphenia curvata (Kütz.) Grun.	vc	c	c	qc	qc	c	vr	vr			vr
Rhopalodia gibba (Ehr.) O. Müll.				vr		vr					
Rh. gibberula (Ehr.) O.Müll.											
Stauroneis acutiuscula Perag. & Hérib.											
S. anceps fo. *gracilis* Rabh.											
S. anceps fo. *linearis* (Ehr.) Hust.											
S. phoenicenteron (Nitz.) Ehr.				vr							
S. phoenicenteron fo. *gracilis* (Ehr.) Hust.											
S. kriegeri Patr.				vr							
S. smithii Grun.											
Stauroneis sp.											
Surirella angustata Kütz.		vr	vr		c	vr	vr	r	qc	r	vr
S. linearis Wm. Smith											
S. linearis v. *constricta* (Ehr.) Grun.											
S. ovata Kütz.		qc	qc	vr		vr	vr			vr	
S. ovata v. *pinnata* (Wm.Smith) Hust.											
S. robusta v. *splendida* (Ehr.) V.H.											
Surirella sp.											
Tropidoneis lepidoptera v. *proboscidea* Cleve				vr							

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
DIATOMS	74.49	77.68	81.07	92.94	86.67	8.065	87.93	78.14	86.20	85.00	89.45	74.92	87.14	76.98	70.58	80.39	83.89	94.76	55.17	73.35	92.01
CENTRALES	63.66	59.95	54.15	54.86	38.20	58.56	44.56	16.73	32.09	76.54	76.13	63.94	61.03	64.81	26.79	68.45	34.59	7.61	45.03	20.90	15.78
Cyclotella atomus Hust.																					
C. bodanica Eulenst.																					
C. comta (Ehr.) Kütz.	0.55	0.22	0.11	0.22		0.14	0.11	0.08	0.28	0.17		0.57	0.54	0.94	1.50	0.64	0.92	0.20	4.60	1.13	0.25
C. comta v. *oligactis* (Ehr.) Grun.																					
C. comensis Grun.													vr			vr			vr	r	vr
C. cryptica Levin, Reimann & Guillard																					
C. kuetzingiana Thw.	0.38	0.11	0.11	0.07	0.10	0.04	0.11	0.04	0.05		0.24	0.69	0.33	0.70	0.50	0.48	0.23	0.01	0.68	0.07	0.11
C. kuetzingiana v. *radiosa* Fricke																					
C. meneghiniana Kütz.	2.42	2.55	0.89	0.50		0.84	0.08	vr 0.04	0.05	1.42	1.07	0.80	1.92	0.55	0.09	1.92	1.28	0.06	vr 0.83	vr	vr
C. meneghiniana v. *plana* Fricke																					
C. michiganiana Skv.	24.39	17.25	9.37	7.30	0.85	8.10	0.92	0.47	1.30	50.21	47.18	36.17	24.51	21.78	4.39	26.91	8.90	1.77	9.88	0.37	0.77
C. ocellata Pant.			0.16	0.12		0.08	0.08	0.17													
C. operculata (Agardh) Kütz.			0.18	0.44	0.05	0.04	0.21	0.31	0.25			0.57	0.84	1.18	2.54	0.88	1.15	0.53	0.75	2.72	1.76
C. pseudostelligera Hust.				0.07		0.08	0.08	0.04				3.65	2.31	3.13	6.55	5.93	5.03	1.02	14.33	9.57	0.86
C. stelligera (Cleve & Grun.) V.H.												0.10	0.19	0.16		0.56	0.10		0.12		
C. striata (Kütz.) Grun.		0.11	0.45	0.07				0.08		0.17		0.69	1.07	0.79	0.58	1.12	0.46	0.06	3.10	1.13	0.05
Cyclotella sp #3																					
Coscinodiscus subsalsa Juhl.-Dannf.	0.38	0.11		0,17	0.10	0.04			0.05			0.24	0.12				0.51	0.12			0.05
Coscinodiscus sp.																					
Melosira granulata (Ehr.) Ralfs	5.58	7.71	9.65	4.91	3.54	10.22	7.74	3.00	6.00	6.46	6.58	4.10	6.51	4.12	4.94	2.33	4.54	0.57	1.15	3.08	1.20
M. granulata v. *angustissima* O. Müll.	24.10	24.17	24.28	22.85	19.24	26.54	16.05	4.16	9.63	11.14	14.26	14.14	18.71	25.21	2.43	20.36	8.31	0.97	5.45	0.46	0.90
M. granulata fo. *spiralis* Grun.														1.51	1.13	1.51			1.45	1.20	

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
M. islandica O. Müll			1.73	3.90	2.26	2.98	1.27	2.07	5.62	1.78	1.21			0.59	0.89	1.42	0.77	1.08	0.17	0.40	3.80
M. italica subsp. *subarctica* O. Müll.						2.85	2.24	0.08	0.05					0.55							0.60
M. varians Ag.	1.12	1.21	0.46	0.46	0.55	0.67	0.71	0.18	0.61	0.20	0.39		0.09	0.08		0.08	0.10	0.03			0.25
Stephanodiscus alpinus Hust. ex. Huber-Pestalozzi			1.51	4.37	4.73	1.10	4.10	2.00	5.10	2.50	2.60	1.15	1.31	2.43	0.96	2.08	1.15	0.93	1.06	0.39	3.47
S. astraea (Ehr.) Grun.	1.56	0.93	0.28	0.44	0.13	0.08	0.05	0.08	0.40	0.17	0.21				0.05			0.03		0.07	0.05
S. binderanus (Kütz.) Krieg.			1.02	4.40	3.87	1.77	7.08	1.73	0.39			0.27	1.61								
S. hantzschii Grun.	0.38	2.20	1.79	2.27	2.19	1.60	2.26	1.30	0.70	0.34	0.18			0.16		0.08	0.06	0.01			0.42
S. minutus Grun. ex Cleve & Müll.	1.04	0.69	0.56	0.39	0.13	0.26	0.27		0.20	0.17	0.21	0.12	0.12	0.16			0.03	0.01	0.22		0.05
S. niagarae Ehr.	vr	vr		vr	vr		vr		vr	r	r		vr		vr	vr	vr	r			r
S. niagarae v. *magnifica* Fricke													vr				vr				
S. subtilis (Van Goor) A. Cl.	1.56	1.74	1.12	0.66	0.05	0.53	0.21			1.60	1.50	0.57	0.54	0.55	0.09	0.96	0.37	0.01		0.07	0.05
S. tenuis Hust. ex Huber-Pestalozzi	0.21	0.81	1.07	0.44	0.27	0.48	0.92	0.70	0.10	0.17	0.24		0.19	0.08	0.05	0.48	0.27				
S. transilvanicus Pant.			0.05	0.12	0.10	0.08	0.05	0.14	1.06					0.08	0.05		0.10	0.17	0.12	0.24	0.84
Rhizosolenia eriensis H.L. Smith																					
R. gracilis H. L. Smith																					
Thalassiosira #1																					
Actinoptychus sp.																					
PENNALES	9.83	17.73	26.92	38.08	48.47	22.09	43.37	61.41	54.11	8.46	13.32	10.98	26.11	12.17	43.79	11.94	49.30	87.15	10.14	52.45	76.23
Achnanthes affinis Grun.																					
A. clevei Grun.	c	c	r	r	r	c	r		vr	c	r	r		vr							vr
A. clevei v. *rostrata* Hust.				vr	vr	vr	vr														vr
A. conspicua A. Mayer	qc	vr		vr			vr			r	vr										

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
A. deflexa Reim.																					
A. exigua Grun.	vr	vr	vr	vr		r	r	vr	vr	r	r	vr	vr	vr		vr					
A. exigua v. *constricta* (Grun.) Hust.		vr								vr	vr										
A. flexella (Kütz.) Brun.																					
A. hungarica (Grun.) Grun.	vr	r	vr	vr		vr				vr	vr	vr	vr	vr							
A. hauckiana Grun.	vr	vr				r	vr			vr											vr
A. hauckiana v. *rostrata* Schulz	r	c	vr	vr	vr	vr	vr			c	c	r	vr	vr		vr					
A. lanceolata (Brébisson) Grun.	c	vc	c	c	vr	vr				c	qc	r		r	vr						r
A. lanceolata v. *apiculata* Patr.																					
A. lanceolata v. *dubia* Grun.	vc	vc	vc	c	qc	c	c		r	vc	c	r	qc	r	r	vr		vr			vr
A. lanceolata v. *omissa* Reim.	r					vr															vr
A. lanceolata v. *elliptica* Cleve		vr				r	vr			r	vr		vr								vr
A. lanceolata v. *bimaculata* Hust.		vr																			
A. lauenburgiana Hust.		r	qc	r	r	r	vr			vr	r	r	vr			qc					
A. linearis (Wm. Smith) Grun.	vr	vr																			
A. lemmermanni Hust.						r															
A. lanceolatoides Sov.																					
A. microcephala (Kütz.) Grun.																qc					
A. minutissima Kütz.	vr	r				vr						vr		vr					vr		
A. oestrupii (A. Cl.) Hust.																					
A. pinnata Hust.	vr	vr				vr			vr	vr	vr			vr							
A. wellsiae Reim.																					
Achnanthes sp. #1																					
Achnanthes sp. #6																					
Achnanthes sp. #14																					
Achnanthes sp. #15		vr	vr																		
Achnanthes sp. #23																					
Achnanthes spp.									vr			vr									

Table 2 (cont.)

MONTH	June 1969													July 1969							
STATION	FP		MP			EP		LAKE		FP		MP(4)		MP(1)		FP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
Amphora bullatoides Horn & Helleman				vr		vr				vr											
A. calumetica (Thomas) Perag.				vr	vr	vr					vr										
A. cruciferoides Stoermer																					
A. hemicycla Stoermer																					
A. huronensis Stoermer																					
A. michiganensis Stoermer						vr	vr														
A. neglecta Stoermer			vr	r	vr	r	qc	r	e									qc			vr
A. normanii Rabh.																					
A. ovalis (Kütz.) Kütz.	e	e	e	e	r	e	r	vr	r	qc	e	r				vr		vr		vr	vr
A. ovalis v. *constricta* Skv.																					
A. ovalis v. *gracilis* (Ehr.) V.H.	r	vr	vr	r	vr	r	vr			vr	r	r		r							vr
A. ovalis v. *libyca* (Ehr.) Cleve	r	vr	vr	r	vr	vr			qc	e	e	e	r	r		r	vr	r		vr	
A. ovalis v. *pediculus* (Kütz.) V.H.	e	e	ve	e	e	c	qc		vr	e	e	qc	r	qc	vr	e					r
A. rotunda Skv.																					
A. sibirica Skv. & Meyer			vr	vr	vr	vr															vr
A. subcostulata Stoermer			vr	vr						vr											
A. veneta Kütz.			vr																		
Amphora sp. (*veneta* v. *angularis*)			r		vr																
Genus *Asterionella* Hass.	1.70	1.69	1.20	1.73	1.22	0.14	0.84	1.43	1.02			0.34	0.82		2.86	0.22	2.66	1.55	0.73	3.32	0.44
Asterionella bleakeleyi Wm. Smith	0.94	0.51	1.04	0.60	0.32		0.30	0.19												0.17	
A. gracillima (Hantz.) Herib.		0.26													1.22		1.06			0.52	
A. formosa Hass.	0.76	0.60	0.16	1.13	0.90	0.14	0.54	1.24	1.02			0.34	0.82		1.64	0.22	1.60	1.55	0.73	2.63	0.44
A. formosa v. *acaroides* Lemm.		0.32																			

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14-	31
Cocconeis diminuta Pant.	qe	qe	e	r	vr	r	vr			qe	e	r	vr	vr		vr		vr			vr
C. disculus (Schum) Cleve										vr	vr			vr							
C. fluviatilis Wallace																					
C. placentula Ehr.	e	ve	e	e	r	e	qe	vr	r	e	e	e	r	r		qe	vr	vr			r
C. placentula v. *euglypta* (Ehr.) Cleve	e	ve	e	e	vr	e	r		r	e	ve	r	vr	vr		r				vr	vr
C. placentula v. *lineata* (Ehr.) V.H.	e	r		vr		vr				vr	vr			vr	vr						
C. pediculus Ehr.	qe	e	r	r		r	vr		vr	qe	e	r		qe	vr			vr		vr	vr
C. rugosa Sov.	vr																				
C. thumensis A. Mayer	r	r	e	r	vr	r	qe		vr	r	qe		vr								vr
Cocconeis sp. #6		vr																			
Cymbella amphicephala Näg. ex Kütz.																					
C. affinis Kütz.	r	vr	vr			vr			vr	vr		vr									
C. cuspidata Kütz.			vr						vr												
C. cistula (Ehr.) Kirchn.		vr	vr											vr							
C. cymbiformis (Agardh? Kütz.) V.H.																					
C. cesatii Grun.				r																	
C. delicatula Kütz.																					
C. ehrenbergii Kütz.																					
C. helvetica Kütz.																					
C. hustedtii Krasske																					
C. lanceolata (Ehr.) Kirchn.											vr										
C. laevis Näg.																					
C. latens Krasske																					
C. prostrata (Berkeley) Cleve	vr	vr	r			vr	vr		vr		vr										
C. reinhardtii Grun.																					
C. leptoceros v. *rostrata* Hust.																					

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
C. sinuata Greg.	qe	qe	vr	qe	r	r		vr		qe	qe	r		vr		vr		vr			vr
C. subventricosa Choln.	r	r																			
C. tumida (Bréb.) V.H.			vr			vr	vr		vr	r	vr	vr									
C. turgida Greg.										vr	vr										
C. turgida v. pseudogracilis Choln.	r	c	c	c		c		vr	vr	r	vr			r							
C. triangulata (Ehr.) Cleve																					
C. turgidula Grun.	vr																				
C. ventricosa Agardh			vr	r	vr	r					vr	vr		vr							vr
Cymbella cistula v. #1																					
Cymbella sp. #2																					
Cymbella sp. #5																					
Cymbella sp. #18																					
Cymbella sp. #21																					
Cymbella spp.											vr				vr						
Genus Diatoma Bory	0.06	0.52	3.76	6.23	9.42	3.80	6.59	12.81	3.96	0.05	0.12	0.34	0.89	0.57	1.17	0.56	1.07	0.12	0.36	0.15	0.44
D. ehrenbergii Kütz.				vr	0.04			0.04								vr					
D. tenue Ag.			0.10	0.14	0.28	0.07	0.27	0.37	0.06				0.74	0.17	0.35	0.11	0.28	0.06			
D. tenue v. elongatum Lyngb.			2.23	4.29	6.94	2.49	4.59	8.69	3.26			0.34	0.15	0.40	0.82	0.45	0.79	0.06	0.36	0.15	0.26
D. tenue v. pachycephala Grun.			1.23	1.70	2.12	1.24	1.73	3.71	0.64												
D. vulgaris Bory	0.06	0.52	0.20	0.10	0.04				vr	0.05	0.12	vr	r	vr		vr	vr	vr			0.18
D. vulgaris v. brevis Grun.	vr								vr		vr										
D. vulgaris v. linearis V.H.											vr										
Genus Fragilaria Lyngb.	0.94	6.64	9.21	14.10	17.78	10.83	20.71	23.40	21.89	3.96	6.58	5.35	16.11	7.24	12.33	5.61	19.88	25.25	6.20	22.50	25.18
F. brevistriata Grun.	c	vc	c	c	r	qe	r	vr		vc	vc	r	r	r	r			vr			qe
F. brevistriata v. inflata (Pant.) Hust.	r	vc			r	r			vr	r	r	vr									r

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
F. brevistriata v. *capitata* Herib.		r		r																	
F. capucina Desm.	0.03	0.17	3.69	7.91	9.37	4.43	8.34	11.31	11.04	0.20		0.24	9.97	0.45	1.41	vr 2.33	4.52	9.96	0.97	0.96	6.55
F. capucina v. *mesolepta* Rabenh.		vr	qc	e	c	qc	e	qc	qc	r		r	vr	vr		vr		vr			
F. capucina v. *lanceolata* Grun.	r	vr	r	vc	vc	c	vc	c	c											vr	
F. construens (Ehr.) Grun.	c	vc	c	c	r	qc				vc	vc	r	r	vr		r		vr			r
F. construens v. *venter* (Ehr.) Grun.				vr	vr	r		vr	vr	vr	vr										vr
F. construens v. *binodis* (Ehr.) Grun.	c	vc	qc	qc	vr	r	r		r	qc	vc	r	r	vr		r	vr				
F. construens v. *pumila* Grun.		vr				vr				vr	vr										
F. construens v. *minuta* Temp. and Perag.					vr	vr	vr			r	r	r				vr					vr
F. crotonensis Kitt.	0.47	2.98	5.13	4.25	6.85	5.73	10.53	11.54	9.55	1.70	3.72	4.64	6.09	6.41	9.65	3.06	14.98	14.91	5.19	21.46	16.72
F. intermedia Grun.	qc	c		qc	r	qc	vr	vr	vr	r	vc	qc	r			r					
F. intermedia v. *fallax* Grun.					qc				r												
F. leptostauron (Ehr.) Hust.	vr	qc		vr			vr			vr											
F. leptostauron v. *dubia* (Grun.) Hust.	vr	c	vr	vr	vr	vr		vr		vr											
F. leptostauron v. *fossilis* (Pant.) Reháková																					
F. lapponica Grun.	vr			vr																	
F. pinnata Ehr.	qc	vc	qc	qc	r	r	r			vr	vr	r	r	vr							qc
F. pinnata v. *lancettula* (Schum.) Hust.	r	qc	r	r		r			r	c	vc	r				r					
F. pinnata v. *intercedens* (Grun.) Hust.																					qc
F. vaucheriae v. *capitellata* (Grun.) Patr.				qc					vr												
F. vaucheriae v. *fallax* Grun.																					
F. vaucheriae v. *truncata* Grev.	r	vc	qc	qc	r	r	vr			vr	vr	vr	vr			vr					

Table 2 (cont.)

MONTH	June 1969									June 1969												
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE			
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
F. crotonensis varieties																					
Fragilaria sp. #6		qe	qe	r	r	qe	qe	qe		qe	ve	r	vr		qe	qe	r				
Fragilaria sp. #9																					
Fragilaria sp. #11																					
Gomphonema acuminatum v. *pusillum* Grun.																					
G. acuminatum v. *coronata* (Ehr.) Rabh.			vr																		
G. abbreviatum v. *inflata* Hust.																					
G. angustatum (Kütz.) Rabh.	r	r	qe	vr	vr	r	vr		vr	e	qe	vr	r	vr	vr	vr					
G. angustatum v. *producta* Grun.	e	e	vr	vr		qe	vr			r	r	vr		vr							
G. bohemicum Reich. & Fricke																					
G. constrictum Ehr.	vr		vr																		
G. clevei Fricke	vr	vr			vr	vr															
G. constrictum v. *capitata* (Ehr.) Cleve																					
G. grovei M. Schm.																					
G. gracile Ehr.	vr									vr		r	r	vr		vr					vr
G. gracile v. *cymbelloides* Grun.			vr																		
G. intricatum Kütz.	r		vr		vr	r										vr					
G. intricatum v. *dichotomum* (Kütz.) Grun.						vr															
G. lanceolatum Ehr.	vr	vr		vr									vr								
G. longiceps v. *subclavata* Grun.																					
G. lanceolatum v. *insignis* (Greg.) Cleve	vr																				
G. olivaceum (Lyngb.) Kütz.	ve	ve	e	e	qe	e	vr	r	qe	e	e	e	r	r	r	r			vr	vr	qe
G. olivaceum v. *minutissima* Hust.		vr								r	r	r	vr		vr						
G. olivaceum v. *calcarea* Cleve	r			vr						r	r	r									vr

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	FP		MP			EP		LAKE		FP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
G. parvulum (Kütz.) Kütz.																					
G. subclavatum Grun.										vr	vr										
G. sphaerophorum Ehr.																					
G. tergestinum (Grun.) Fricke						vr															
Gomphonema sp. #2																					
Gomphonema sp. #3																					
Gomphonema sp. #10																					
Gomphonema spp.																					
Genus *Navicula* Bory	2.41	2.56	0.95	1.01	0.58	0.67	0.35	0.08	0.37	0.37	1.48	0.26	0.19	0.12	0.05	0.15	0.38	0.31	0.12	0.15	0.39
N. anglica Ralfs			vr	r	vr										vr						
N. anglica v. *subsalsa* (Grun.) Cleve				vr		vr			vr												
N. anglica v. *signata* Hust.									vr								vr				
N. [illegible] Sov.											vr							vr			vr
N. bacillum Ehr.											vr										
N. capitata Ehr.	qe	e	e	qe	vr	qe	vr		vr	r	vr					vr					vr
N. capitata v. *hungarica* (Grun.) Ross		vr	vr	vr		vr	r			vr	vr		vr	vr							
N. capitata v. *luneburgensis* (Grun.) Patr.	vr		vr					vr	r			vr	vr					vr			
N. cuspidata Kütz.			vr	r					vr	vr	vr										
N. [illegible] Hohn						vr	vr							vr							
N. cincta (Ehr.) Ralfs																					
N. clementis Grun.																					
N. clementis v. *linearis* Bander																					
N. clementis v. *quadristigmata* Mang.							vr		vr					vr				vr			
N. costulata Grun.				r	vr		vr	vr				vr		vr			vr			vr	vr
N. contenta v. *biceps* (Arn.) V.H.		vr																			

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	FP		MP			EP		LAKE		FP		MP(4)		MP(1)		FP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
N. confervacea (Kütz.) Grun.	r	vr		vr		vr				vr			vr								vr
N. crucicula (W. Sm.) Donk.	vr																				
N. cuspidata v. obtusa Patr.																					
N. canalis Patr.																					
N. cryptocephala Kütz.	vr		r	vr	vr	vr	vr			r	r		vr					vr			
N. cryptocephala v. intermedia Grun.	qe	e	r	qe	vr	r	vr			r	qe		r	r		r		vr		vr	
N. cryptocephala v. veneta (Kütz.) Rabh.		qe	vr			r				vr			vr			vr					
N. decussis Øst.	ve	ve	e	e	r	e	r	r	r	qe	ve	qe	e	qe		vr		r			
N. elginensis (Greg.) Ralfs		vr	r																		
N. elginensis v. rostrata (A. Mayer) Patr.						vr															
N. exiguaformis Hust.			vr																		
N. exigua Greg. ex Grun.																					
N. explanata Hust.																					
N. gastrum (Ehr.) Kütz.	e	e	r	r	vr	qe	vr			qe	e	r		vr	vr			vr			
N. gastrum v. signata Hust.				vr		vr				vr		vr		vr							
N. gregaria Donk.	vr	r	vr				vr														vr
N. gastriformis Hust.	r	vr									vr	vr	vr	vr		vr					
N. grimmei Krasske											vr					vr					
N. globosa Meist.																					
N. heufleri Grun.		qe	r	vr		r	vr			r			vr	vr							
N. hassiaca Krasske																					
N. integra (Wm. Smith) Ralfs				vr		vr				vr	vr										
N. ingenua Hust.			vr									vr									
N. insignita Hust.																					
N. imbricata Bock																					
N. lacustris Greg.				vr									vr								
N. latens Krasske		vr	qe	e	e	r	e	qe	e	vr		r		vr			vr	r			vr
N. lanceolata (Agardh) Kütz.	e	qe	e	r	r	r	vr	vr		vr	r	vr	vr			vr					

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
N. menisculus Schum.																					
N. menisculus v. upsaliensis Grun.	vr		r	vr		vr		vr			vr	vr	r								
N. mutica v. tropica Hust.	vr	r	r	r	vr	vr			vr												
N. mutica v. cohnii (Hilse) Grun.						vr				vr											
N. minima Grun.																					
N. oblonga (Kütz.) Kütz.				vr																	vr
N. odiosa Wallace																					
N. oppugnata Hust.											qc	vr	qc			vr					
N. paludosa Hust.		c	vr	vr		qc	vr		vr	r	vr	vr	vr								
N. permitis Hust.			vr																		
N. placentula (Ehr.) Kütz.			vr	vr						vr		vr						vr			
N. placentula v. rostrata A. Mayer						r				vr	vr		vr								
N. platystoma v. pantocsekii Wisl. and Kolbe						vr	r		vr					vr				r			
N. platystoma Ehr.																					
N. protracta Grun.				r	vr					vr	vr										
N. protracta v. elliptica Gallik	vr		vr									r				vr		vr			
N. peregrina (Ehr.) Kütz.					vr																
N. pupula Kütz.	vr	r	vr					vr	vr	vr	r	vr	vr	vr							
N. pupula v. capitata Skv. and Meyer																					
N. pupula v. rectangularis (Greg.) Grun.	vr	vr	vr			vr															
N. pupula v. mutata (Krasske) Hust.					vr	vr						vr	vr								vr
N. pupula v. rostrata Hust.																					
N. pygmaea Kütz.	r	vr		vr		vr							vr			vr					
N. radiosa Kütz.	vr	vr	vr			vr				vr	vr	vr									vr
N. radiosa v. parva Wallace																					

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	FP		MP			EP		LAKE		FP		MP(4)		MP(1)		FP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
N. radiosa v. *tenella* (Bréb.) Grun.	vr	vr	r			vr				vr	vr										
N. reinhardtii (Grun.) Grun.		vr	vr						vr		r	vr	vr								
N. reinhardtii v. *elliptica* Herib.	vr		vr			vr			vr	vr		vr									
N. rhynchocephala Kütz.																					
N. rhynchocephala v. *germainii* (Wallace) Patr.																					
N. rhynchocephala v. *amphiceros* (Kütz.) Grun.																					
N. rotunda Hust.																					
N. subtilissima Patr.																					
N. scutelloides Wm. Smith	r	vr	vr	vr		vr					qc	vr	vr								
N. schroeteri v. *escambia* Patr.																					
N. seminulum Grun.		vr																			
N. simplex Krasske																					
N. stroemii A. Cl.																					
N. symmetrica Patr.																					
N. tantula Hust.																					
N. tenera Patr.																					
N. tripunctata (O.F. Müll.) Bory	vc	vc	vc	vc	c	c	qc	r	qc	qc	vc	r	c	qc	vr	qc	vr			vr	vr
N. tripunctata v. *cuneata* Lange		r	vr	r		vr					vr	vr	vr								
N. tripunctata v. *schizonemoides* (V.H.) Patr.	qc	qc	r	qc	vr	c				qc	vc	r	vr	vr						vr	
N. tuscula Ehr.																					
N. tuscula fo. *obtusa* Hust.						vr															
N. tuscula fo. *rostrata* Hust.										vr											
N. vanheurckii Patr.																					
N. variostriata Krasske																					
N. viridula (Kütz.) Kütz.	vc	vc	qc	qc	vr	c	vr			qc	vc	vr	vr			vr					
N. viridula v. *avenacea* (Bréb.) V.H.			vr	vr	vr	vr				vr	vr										

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
N. viridula v. *linearis* Hust.																					
N. viridula v. *rostellata* (Kütz.) Cleve				vr		vr				vr	r										
N. vulpina Kütz.										vr	vr										
N. wittrockii (Lagerstedt) A. Cl.																					
Navicula sp. (*pygmaea* v. *producta*)				vr							vr										
Navicula sp. #8 (*aff. lanceolata*)		r		qc		vr				qc	vr	vr		vr		vr					
Navicula sp. #18						vr				vr	vr										
Navicula sp. #19	r																				
Navicula sp. #22																					
Navicula sp. #23										vr											
Navicula sp. #25																					
Navicula sp. #27							vr		vr	vr	vr										
Navicula sp. #36				r																	
Navicula sp. #38																					
Navicula sp. #40																					
Navicula sp. #43			vr	vr			vr			vr	vr	vr									
Navicula sp. #44																					
Navicula spp. "A"																					
Navicula sp.			r	r	r	qc	r		r			vr									
Navicula sp.						vr										vr					vr
Navicula sp.											qc										
Navicula sp.																					
Navicula sp.																					vr
Navicula sp.																					
Navicula sp.																					
Genus *Nitzschia* Hass. *N. acicularis* (Kütz.) Wm. Smith	1.58	2.30	1.46	1.68	1.19	0.39	1.67	1.03	1.35	1.85	1.49	1.60	1.69	1.20	0.80	3.13	2.04	1.05	0.85	0.15	0.83

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	:	8	15	1	14	31
N. acuminata (Wm. Smith) Grun.																					
N. acuta Hantz.	vr	vr		vr		r							vr								
N. amphibia Grun.	c	c	r	vr		vr	r	r		qc	r	vr	r	vr		vr					
N. amphibia v. *fossilis* Grun.												vr	vr								
N. angustata (Wm. Smith) Grun.										vr											
N. angustata v. *acuta* Grun.				vr						vr	vr										
N. apiculata (Greg.) Grun.			vr	vr		vr			vr	qc	c	r	vr	vr							
N. bacillum Hust.		vr	qc	c	c	qc	c	qc			vr		r		vr	vr					r
N. capitellata Hust.												r									
N. commutata Grun.																					
N. confinis Hust.			vr																		
N. denticula Grun.																					
N. dissipata (Kütz.) Grun.	vr	r	r							vr			r	r	vr		c	qc			
N. dissipata v. *media* (Hantz.) Grun.																					
N. fonticola Grun.	r	r	r			vr	vr					vr	vr					vr			
N. frustulum (Kütz.) Grun.																					
N. frustulum v. *perminuta* Grun.																					
N. frustulum v. *perpusilla* (Rabh.) Grun.																					
N. hungarica Grun.	c	c	c	r	r	qc	r		vr	c	c	qc	vr	r		vr				vr	r
N. holsatica Hust.																					
N. interrupta (Reich.) Hust.																					
N. [illegible] Hust.						vr															
N. linearis Wm. Smith	r	r	r	vr		vr				qc	vr	vr									
N. palea (Kütz.) Wm. Smith			vr			vr							r		vr	vr					
N. parvula Wm. Smith												vr				vr					
N. recta Hantz.		r	r	r	r	r	r		vr	vr	r		vr	r	vr			r			
N. romana Grun.			vr	vr	vr							vr									
N. sigmoidea (Nitz.) Wm. Smith	vr	vr		vr	vr						r										vr
N. sigma (Kütz.) Wm. Smith		vr				vr						vr					vr				

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP			MP		EP		LAKE		PP		MP(4)		MP(1)			EP			LAKE	
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
N. spiculoides Hust.																					
N. sublinearis Hust.																					
N. subtilis (Kütz.) Grun.																					
N. stagnorum Rabh.																					
N. thermalis (Ehr.) Auersw.	vr																				
N. thermalis v. *intermedia* Grun.										r	c	r	c	r		c					
N. thermalis v. *minor* Hilse										vr											
N. tryblionella Hantz.																					
N. tryblionella v. *debilis* (Arn.) A. Mayer						vr	vr			vr	vr	vr									
N. tryblionella v. *levidensis* (Wm. Smith) Grun.		vr																			
N. tryblionella v. *victoriae* Grun.	qc	c	r	r						r	r										
N. wolterecki Hust.			vr								vr			vr							
Nitzschia sp. "A"			vr			vr				c	qc	r	vr			qc			vr		
Nitzschia sp. "B"																					
Nitzschia sp. #1																					
Nitzschia sp. #2			qc	c	c	qc	c	qc	c							vr					qc
Nitzschia sp. #6	c	c	qc	r	vr	qc	qc	vr	r	c	vc	c	c	c	qc	c					qc
Nitzschia sp. #7	vr	vr	r			vr					vr		r		vr	c			vr	vr	
Nitzschia sp. #8																					
Nitzschia sp. #9																					
Nitzschia sp.																					
Nitzschia sp.												r	vr								
Nitzschia sp.																					
Nitzschia spp.																					
Genus *Synedra* Ehr.	0.75	1.05	1.68	2.30	2.17	1.61	2.94	5.87	4.29	1.11	1.53	1.05	1.17	0.94	0.23	1.07	0.28	0.19	0.36	0.15	1.33
S. ulna Kütz.		r	r	vr	vr	r				vc	vc	c	c	qc	vr	c	r		vr	vr	
S. amphicephala Kütz.		vr						r													

Table 2 (cont.)

MONTH / STATION / DEPTH, METERS	June 1969 PP 1	PP 8	MP 1	MP 5	MP 11	EP 1	EP 16	LAKE 1	LAKE 20	July 1969 PP 1	PP 8	MP(4) 1	MP(4) 16	MP(1) 1	MP(1) 15	EP 1	EP 8	EP 15	LAKE 1	LAKE 16	LAKE 31
S. capitata Ehr.		vr																			
S. delicatissima Wm. Smith										vr	r	vr	qc	vr		c	vr			vr	
S. delicatissima v. angustissima Grun.		vr	r	c	c	qc	qc	r					qc	qc	vr	qc	vr				
S. demerarae Grun.					vr	vr		vr	r			vr	vr								vr
S. fasciculata (Agardh) Kütz.		vr	r	vr		r					vr					vr					
S. filiformis Grun.																					
S. filiformis v. exilis A.Cl.													vr								
S. minuscula Grun.		vr																		vr	
S. ostenfeldii (Krieg.) A.Cl.			vr	vr	r		vr														vr
S. parasitica (W. Smith) Hust.	vr	qc	r	vr		r				r		vr				vr					
S. parasitica v. subconstricta (Grun.) Hust.	vr	vr		vr	vr	vr	vr				vr					vr					
S. pulchella Ralfs																					
S. pulchella v. lanceolata O'Meara																					
S. pulchella v. lacerata Hust.						vr					vr										
S. rumpens Kütz.						r															
S. rumpens v. fragilarioides Grun.		vr																			
S. tenera Wm. Smith				vr																	
S. ulna (Kütz.) Ehr.	vc	c	c	r	r	c	c		r	c	vc	r	vr	qc		vr		r			vr
S. ulna v. chaseana Thomas	vr		vc	vc	vc	vc	vc	vc	vc			r	qc	qc	r	vr	r	r		r	c
S. ulna v. contracta Østr.	vr	vr	vr	qc	vr	r			vr	r	vr		vr								
S. ulna v. constricta Venkt.	vr			vr		r															
S. ulna v. claviceps Hust.	vr	qc				vr					r	vr									vr

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
S. ulna v. *danica* (Kütz.) V.H.	vr	vr	r	qc	c	c	r	c	c				vr		vr		vr	vr	vr	vr	vr
S. ulna v. *longissima* (Wm. Smith) Brun																					
S. ulna v. *subaequalis* (Grun.) V.H.																					
S. ulna v. *spathulifera* (Grun.) V.H.	qc	qc	vr	vr	vr	r	vr		r	vc	vc	c	c	vr		r					vr
S. ulna v. *oxyrhynchus* (Kütz.) V.H.																					
Synedra sp. (*rumpens* v. *fragilarioides*)			vc	c	qc	c	c		qc	vr				qc							qc
Synedra sp. (*capitata* v. *fossilis*)		vr																			
Synedra sp. "A"		vr				vr					vr										
Genus *Tabellaria* Ehr.			6.79	9.10	15.69	4.04	9.85	16.54	19.84		0.20	1.70	4.28	1.95	25.97	1.07	22.78	58.17	0.12	26.03	46.70
T. fenestrata (Lyngb.) Kütz.			6.51	8.10	15.35	4.04	9.45	16.10	19.56		0.20	1.70	4.28	1.95	24.84	1.07	22.71	58.17	0.12	25.44	46.07
T. fenestrata v. *geniculata* A.Cl.																					
T. flocculosa (Roth) Kütz.			0.28	1.01	0.34		0.41	0.44	0.28						1.13		0.07			0.60	0.63
Amphiprora ornata Bail.	vr	vr		r	vr				vr	vr			vr								
Amphipleura pellucida (Kütz.) Kütz.		vr	vr				vr	r													
Anomoeoneis sphaerophora (Ehr.) Pfitz.		vr	vr																		
Bacillaria paxillifer (O.F. Müll.) Hendy	vr	[illegible]	r		vr						vr		vr								

Table 2 (cont.)

MONTH	June 1969													July 1969							
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
Caloneis amphisbaena (Bory) Cleve	vr		r	vr		vr				r	vr		vr								
C. bacillum (Grun.) Cleve																					
C. bacillaris v. *thermalis* (Grun.) A.Cl.																					
C. bacillum v. *lancettula* (Schulz) Hust.																					
C. lewisii Patr.																					
C. ventricosa (Ehr.) Meist.			vr																		
C. ventricosa v. *truncatula* (Grun.) Meist.														vr				vr			
C. ventricosa v. *subundulata* (Grun.) Patr.				vr																	
Cymatopleura elliptica (Bréb. & Godey) Wm. Smith											vr										
C. solea (Bréb. & Godey) Wm. Smith	vr	r	vr	qc	qc	r	r	vr	c	vr	c		vr	vr	vr		vr	vr			
C. solea v. *apiculata* (Wm. Smith) Ralfs			vr	c	c	vr	r	vr	r											vr	
Denticula tenuis v. *crassula* (Naeg.) Hust.				vr																	
Diploneis puella (Schum.) Cleve																					
D. [illegible] (Schmidt) Cleve																					
D. subovalis Cleve				vr		vr	vr														
Diploneis sp. #1								vr			vr										
Diploneis sp.																				vr	
Diploneis sp.																					

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	FP		MP			EP		LAKE		FP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
Epithemia argus (Ehr.) Kütz.	vr																				
E. intermedia Fricke											vr										
E. sorex Kütz.				vr																	
E. turgida (Ehr.) Kütz.														vr							
E. zebra (Ehr.) Kütz.																					
E. zebra v. *porcellus* (Kütz.) Grun.									vr		r										
Epithemia sp.																					
Eunotia arcus Ehr.																					
E. arcus v. *bidens* Grun.																					
E. curvata (Kütz.) Lagerst.	vr	r	vr			vr								vr							
E. formica Ehr.										vr	r										
E. pectinalis v. *minor* (Kütz.) Rabh.										vr	vr										
E. pectinalis v. *ventricosa* Grun.																					
E. vanheurckii Patr.																					
Eunotia sp.											vr										
Frustulia rhomboides v. *amphipleuroides* (Grun.) Cleve	vr																				
F. vulgaris (Thw.) DeToni				vr		vr															
F. weinholdii Hust.											vr										
Frustulia sp.																					
Gyrosigma acuminatum (Kütz.) Rabh.																					
G. attenuatum (Kütz.) Rabh.	vr	vr	vr	vr																	
G. spencerii v. *curvula* (Grun.) Reim.		vr									r									vr	
G. scalproides (Rabh.) Cleve		vr									vr										
G. wormleyi (Sulliv.) Boyer			vr		vr																
Gyrosigma sp.													vr								

Table 2 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
Hantzschia amphioxys (Ehr.) Grun.																					
Mastogloia grevillei W. Smith												vr									
M. smithii Thw.						vr															
M. smithii v. *lacustris* Grun.																					
Meridion circulare (Grev.) Agardh			vr							vr	vr										
M. circulare v. *constrictum* (Ralfs) V.H.	vr	qc			vr	r	vr			vr	vr	vr									
Neidium affine (Ehr.) Pfitz.										vr				vr							
N. binode (Ehr.) Hust.		vr								vr											
N. dubium (Ehr.) Cleve	vr	vr									vr										
N. dubium fo. *constrictum* Hust.						vr	vr			r										vr	
N. iridis (Ehr.) Cleve		vr							vr	vr											
N. iridis v. *amphigomphus* (Ehr.) A. Mayer											vr										
N. productum (Wm. Smith) Cleve																					
N. temperei Reim.																					
Neidium sp. #3																					
Neidium sp.																					
Oestrupia zachariasi (Reich.) Stoermer																					
O. zachariasi v. *undulata* (Schulz) Stoermer				vr		vr												vr			
Opephora martyi Hérib.	r	c	r	r		r	vr		vr	c	c	r				vr				vr	
Pinnularia abaujensis (Pant.) Ross																					
P. acrosphaeria Wm Smith																					
P. biceps Greg.		vr																			
P. biceps fo. *petersenii* Ross										vr											

Table 2 (cont.)

MONTH	June 1969									July 1969										
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE	
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
P. brebissonii (Kütz.) Rabh.	vr	vr	vr	vr																	
P. borealis Ehr.							vr			vr				vr							
P. burkii Patr.																					
P. intermedia (Lagerst.) Cleve																					
P. leptosoma (Grun.) Cleve							vr														
P. obscura Krasske						vr				vr					vr						
P. rupestris Hantz.																					
Pinnularia sp.																					
Rhoicosphenia curvata (Kütz.) Grun.	c	vc	c	c	qc	c	qc		r	c	c	c	r	r	vr	r					r
Rhopalodia gibba (Ehr.) O. Müll.	vr			vr																	
Rh. gibberula (Ehr.) O. Müll.		vr								vr	r		vr								
Stauroneis acutiuscula Perag. & Hérib.																					
S. anceps fo. *gracilis* Rabh.																					
S. anceps fo. *linearis* (Ehr.) Hust.																					
S. phoenicenteron (Nitz.) Ehr.																					
S. phoenicenteron fo. *gracilis* (Ehr.) Hust.																					
S. kriegeri Patr.		vr																			
S. smithii Grun.																					
Stauroneis sp.											vr	vr									
Surirella angustata Kütz.	vr	r	r	r	r		r			r			vr				vr	vr		vr	
S. linearis Wm. Smith				vr																	
S. linearis v. *constricta* (Ehr.) Grun.																					
S. ovata Kütz.			vr	vr		r		vr		vr			vr	vr						r	
S. ovata v. *pinnata* (Wm. Smith) Hust.																					
S. robusta v. *splendida* (Ehr.) V.H.																vr					
Surirella sp.										vr											
Tropidoneis lepidoptera v. *proboscidea* Cleve				vr						vr											

Table 2 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
DIATOMS	57.34	73.59	71.80	40.83	50.69	69.93	46.19	49.80	43.83	3.67	1.42	7.79	75.01	0.45	0.40	60.82	83.56
CENTRALES	50.64	64.01	61.77	35.81	45.58	58.79	24.09	24.73	37.70	0.87	0.39	3.75	35.36	0.30	0.40	26.76	41.68
Cyclotella atomus Hust.																	
C. bodanica Eulenst.																	
C. comta (Ehr.) Kütz.	0.14			0.20	0.21	0.22	1.09	1.23	1.94	0.61	0.04	0.16	1.38	0.03	0.10	1.02	2.52
C. comta v. *oligactis* (Ehr.) Grun.																	
C. comensis Grun.	2.87	5.39	2.51	1.02	2.61	4.26	0.02	0.08	0.92								
C. cryptica Lewin, Reimann & Guillard	0.62	3.83	1.15	0.56	1.70	1.84	0.02	0.01	0.50								
C. kützingiana Thw.	0.23																
C. kützingiana v. *radiosa* Fricke				0.03	0.04		0.02		0.08		0.04			0.03		0.09	0.02
C. meneghiniana Kütz.	1.50	4.90	3.35	1.48	0.89	3.31	0.09	0.35	1.37								
C. meneghiniana v. *plana* Fricke											0.03			0.03			
C. michiganiana Skv.	24.81	19.92	24.95	7.45	10.02	20.23	4.70	4.46	11.22	0.13	0.03	0.16	0.52	0.03	0.10	0.50	1.09
C. ocellata Pant.	0.09		0.09	0.03		0.10	0.02	0.01	0.08			0.02	0.06	0.03			0.59
C. operculata (Agardh) Kütz.			0.27	0.30	0.58	0.28	0.12	0.26	1.48		0.04	0.02	0.69	0.03	0.10	0.09	0.30
C. pseudostelligera Hust.		0.07	0.09	0.04	0.11		0.02	0.01									
C. stelligera (Cleve & Grun.) V.H.	0.09	0.08	0.0[illegible]		0.21			0.01	0.08		0.03		0.06				
C. striata (Kütz.) Grun.	1.12	0.13	0.97														
Cyclotella sp. #3					vr												
Coscinodiscus subsalsa Juhl.-Dannf.		0.08	0.33	0.03	0.04	0.28	0.09	0.10	0.08		0.04						
Coscinodiscus sp.	0.56	0.60	0.33	0.07	0.36	0.57	0.02	0.01	0.08							0.09	0.02
Melosira granulata (Ehr.) Ralfs	11.97	19.95	14.97	16.51	23.62	20.25	16.13	15.34	14.95	0.13	0.04	1.70	19.62	0.04	0.10	23.75	18.20
M. granulata v. *angustissima* O. Müll.	4.86	6.59	11.14	7.85	4.58	6.55	1.20	2.39	2.43			1.53	11.22	0.04		1.34	1.59
M. granulata fo. *spiralis* Grun.																	

Table 2 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
M. islandica O. Müll.											0.03	0.02	1.24				15.71
M. italica subsp. *subarctica* O. Müll.																	
M. varians Ag.	0.35	0.33	0.28		0.04		0.02		0.91								
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi			0.09	0.09	0.15	0.28	0.29	0.35	0.96		0.04	0.02	0.29	0.04		0.05	0.60
S. astraea (Ehr.) Grun.	0.14		0.09	0.03		0.10			0.08								
S. binderanus (Kütz.) Krieg.													0.06			0.09	
S. hantzschii Grun.		0.31	0.09	0.04	0.17	0.16		0.01	0.08								0.02
S. minutus Grun. ex Cleve & Müll.	0.14	0.13		0.04		0.22	0.02	0.01	0.08			0.02	0.06				0.02
S. niagarae Ehr.		vr	vr		vr	vr		vr									
S. niagarae v. *magnifica* Fricke																	
S. subtilis (Van Goor) A. Cl.	0.80	1.00	0.90		0.17				0.08								
S. tenuis Hust. ex Huber-Pestalozzi	0.33	0.66		0.03	0.04	0.16											0.02
S. transilvanicus Pant.							0.09		0.08		0.03		0.06				0.02
Rhizosolenia eriensis H. L. Smith																	
R. gracilis H. L. Smith																	
Thalassiosira #1																	
Actinoptychus sp.																	
PENNALES	6.70	9.58	10.03	5.02	5.11	11.14	22.10	25.07	6.13	2.80	1.03	4.04	39.65	0.15		34.06	41.88
Achnanthes affinis Grun.							r	r	c								vr
A. clevei Grun.	c	c	c	r	r	c	vr	vr	r			vr					
A. clevei v. *rostrata* Hust.						vr	vr										vr
A. conspicua A. Mayer	vr	qc			vr	vr											

Table 2 (cont.)

MONTH STATION DEPTH, METERS	August 1969 FP 1	6	8	NP 1	5	9	EP 1	5.5	7	LAKE(1) 1	5	11	16.5	LAKE(2) 1	5	18	26
A. deflexa Reim.																	
A. exigua Grun.		vr															
A. exigua v. *constricta* (Grun.) Hust.	vr	r	r	vr		r	vr	vr	vr								
A. flexella (Kütz.) Brun.																	
A. hungarica (Grun.) Grun.																	
A. hauckiana Grun.	vr	qc	qc	vr	vr	c											
A. hauckiana v. *rostrata* Schulz		vr	vr		r	r											
A. lanceolata (Brébisson) Grun.	c	c	c	r	qc	c		vr	vr								
A. lanceolata v. *apiculata* Patr.	vr	c	c	r	r	vc		vr	r								
A. lanceolata v. *dubia* Grun.	vr																
A. lanceolata v. *omissa* Reim.	vc	vc	vc	c	qc	vc	r	c	c								
A. lanceolata v. *elliptica* Cleve		vr		vr	vr	vr	vr										
A. lanceolata v. *binaculata* Hust.	vr	vr	r	vr	vr	vr											
A. lauenburgiana Hust.									vr								
A. linearis (Wm. Smith) Grun.	r	r			vr	r			vr								
A. lemmermanni Hust.																	
A. lanceolatoides Sov.					vr	vr			vr								
A. microcephala (Kütz.) Grun.						vr											
A. minutissima Kütz.																	
A. oestrupi (A.Cl.) Hust.		r	vr	vr	vr	r											
A. pinnata Hust.																	
A. [illegible] Reim.		vr	vr	vr	vr	vr		vr									
Achnanthes sp. #1			vr														
Achnanthes sp. #6																	
Achnanthes sp. #14																	
Achnanthes sp. #15																	
Achnanthes sp. #23																	

Table 2 (cont.)

MONTH / STATION / DEPTH, METERS	August 1969 FP 1	FP 6	FP 8	MP 1	MP 5	MP 9	EP 1	EP 5.5	EP 7	LAKE(1) 1	LAKE(1) 5	LAKE(1) 11	LAKE(1) 16.5	LAKE(2) 1	LAKE(2) 5	LAKE(2) 18	LAKE(2) 26
Amphora bullatoides Hohn & Hellerman																	
A. calumatica (Thomas) Perag.		vr							vr								
A. cruciferoides Stoermer					vr	vr	r	r	qe								vr
A. hemicaela Stoermer	vr																
A. huronensis Stoermer						vr	vr										
A. michiganensis Stoermer																	
A. neglecta Stoermer																	
A. normanii Rabh.			vr	vr	r	r	vr	ve	qe			vr					
A. ovalis (Kütz.) Kütz.					vr	vr										vr	
A. ovalis v. *constricta* Skv.	vr	e	e	vr	qe	r	vr	vr									
A. ovalis v. *gracilis* (Ehr.) V.H.																	
A. ovalis v. *libyca* (Ehr.) Cleve	qe	e	e	vr	qe	e	vr		e				vr				
A. ovalis v. *pediculus* (Kütz.) V.H.	e	e	e	r	e	e	r	e	e				vr				
A. rotunda Skv.	e	e	e	qe	e	e	r	e	e								
A. sibirica Skv. & Meyer																	vr
A. subcostulata Stoermer				vr	qe	r	e	qe	r								
A. veneta Kütz.																	
Amphora sp. (*veneta* v. *angularis*)		vr															
Genus *Asterionella* Hass.																	
Asterionella bleakeleyi Wm. Smith		0.06	0.56	0.13	vr	vr	0.21	0.29	0.02				0.61			3.00	
A. gracillima (Hantz.) Heib.																	
A. formosa Hass.																	
A. formosa v. *acaroides* Lemm.		0.06	0.56	0.13	vr	vr	0.21	0.29	0.02				0.61			3.00	

Table 2 (cont.)

MONTH	August 1969															
STATION	PP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
Cocconeis diminuta Pant.	c	vc	qc	r	vr	vc	vr	vr									
C. disculus (Schum.) Cleve		vr	vr			vr											
C. fluviatilis Wallace																	
C. placentula Ehr.	c	vc	vc	qc	c	vc	c	r	c		vr	vr					vr
C. placentula v. *euglypta* (Ehr.) Cleve	c	vc	vc	c	vc	vc	r	c	c							vr	
C. placentula v. *lineata* (Ehr.) V.H.	c	c	r	vr	vr	qc	vr	vr	c								
C. pediculus Ehr.	qc	c	c	r	c	vc	c	c	vc							vr	
C. rugosa Sov.				vr		vr											
C. shumensis A. Mayer	qc	qc	vr	qc	vr	c	r	r	vr								
Cocconeis sp. #6																	
Cymbella amphicephala Näg. ex Kütz.			vr			vr											
C. affinis Kütz.	vr	r	r		vr	r			vr								
C. cuspidata Kütz.		vr				vr		vr									
C. cistula (Ehr.) Kirchn.	vr					r		vr									
C. cymbiformis (Agardh? Kütz.) V.H.																	
C. cesatii Grun.					vr												
C. delicatula Kütz.																	
C. ehrenbergii Kütz.																	
C. helvetica Kütz.																	
C. hustedtii Krasske																	
C. lanceolata (Ehr.) Kirchn.																	
C. laevis Näg.																	
C. latens Krasske																	
C. prostrata (Berkeley) Cleve	vr	vr	r			vr			vr								
C. reinhardtii Grun.					vr												
C. leptoceros v. *rostrata* Hust.				vr	vr	vr											

Table 2 (cont.)

MONTH	August 1969																
STATION	FP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
C. sinuata Greg.	r	qe	r	vr	r	e	vr	vr	r								
C. subventricosa Choln.		vr															
C. tumida (Bréb.) V.H.		r	vr			qe		vr									
C. turgida Greg.																	
C. turgida v. *pseudogracilis* Choln.	r	r	r														
C. triangulata (Ehr.) Cleve																	
C. tumidula Grun.									vr					vr			
C. ventricosa Agardh	vr	r	e	vr	qe	ve	vr	vr	r								
Cymbella cistula v. #1																	
Cymbella sp. #2																	
Cymbella sp. #6																	
Cymbella sp. #18																	
Cymbella sp. #21		vr	vr														
Cymbella spp.																	
Genus *Diatoma* Bory	0.23	0.06	0.10	vr	vr	0.19	0.11	0.19	0.16				0.44			0.10	
D. ehrenbergii Kütz.						vr											
D. tenue Ag.									vr								
D. tenue v. *elongatum* Lyngb.																	
D. tenue v. *pachycephala* Grun.				vr	vr	vr		0.19	0.16				0.44			0.10	
D. vulgaris Bory	0.23	0.06	0.10	vr	vr	0.12	0.11	r	r								
D. vulgaris v. *brevis* Grun.	vr	0.02	vr			0.07											
D. vulgaris v. *linearis* V.H.	vr	r	vr			vr											
Genus *Fragilaria* Lyngb.	1.73	2.84	3.46	2.83	1.49	2.85	11.97	17.61	2.70	2.52	0.40	3.56	33.17			22.24	13.36
F. brevistriata Grun.	e	ve	e		r	r	r	r	r								
F. brevistriata v. *inflata* (Pant.) Hust.	qe	e	e	qe	r	r	qe	qe	qe								

Table 2 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
F. brevistriata v. *capitata* Hérib.	vr		vr			qe											
F. capucina Desm.	0.05	0.18	0.09	0.01	0.32	0.34	3.18	4.31	0.65	0.60	0.20		3.77			4.93	6.25
F. capucina v. *mesolepta* Rabenh.	vr	e	qe	vr	e	e	vr	r	ve				qe	vr		qe	e
F. capucina v. *lanceolata* Grun.			r		r				r								
F. construens (Ehr.) Grun.	e	e	e	e	e	e	e	e	r		vr						
F. construens v. *venter* (Ehr.) Grun.	r	vr		vr	r	r	vr	r	r								
F. construens v. *binodis* (Ehr.) Grun.	vr	qe	e	vr	qe	e	ve	e	qe								
F. construens v. *pumila* Grun.	vr			vr		r			vr								
F. construens v. *minuta* Temp. and Perag.	vr	vr	vr	vr	qe	e		r	qe								
F. crotonensis Kitt.	0.33	1.40	2.75	2.10	0.89	1.00	4.24	5.93	1.47	1.80	0.20	3.09	27.73			17.31	7.11
F. intermedia Grun.	qe	e	e	e	qe	e	e	e	qe				qe				
F. intermedia v. *fallax* Grun.																	
F. leptostauron (Ehr.) Hust.			r			vr											
F. leptostauron v. *dubia* (Grun.) Hust.	vr	r	vr		vr	vr	r	vr									
F. leptostauron v. *fossilis* (Pant.) Reháková																	
F. lapponica Grun.																	
F. pinnata Ehr.	qe	qe	qe	r	r	e	qe	r	r								
F. pinnata v. *lancettula* (Schum.) Hust.	r	e	r	r	r	e		r	r								
F. pinnata v. *intercedens* (Grun.) Hust.																	
F. vaucheriae v. *capitellata* (Grun.) Patr.				r	qe	ve	r	e	qe			vr					
F. vaucheriae v. *fallax* Grun.																	
F. vaucheriae v. *truncata* Grev.		e	qe		r	r	r	r	r								

Table 2 (cont.)

MONTH	August 1969																
STATION	FP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
F. crotonensis varieties	r	vc	vc	vc	vc	vc	c	c	c								
Fragilaria sp. #6	r	r		vr	vr	vr											
Fragilaria sp. #9		qc	qc	qc	qc	qc	r	vr									
Fragilaria sp. #11	vr	qc	qc	r	r	r			vr								
Gomphonema acuminatum v. *pusillum* Grun.		vr															
G. acuminatum v. *coronata* (Ehr.) Rabh.																	
G. abbreviatum v. *inflata* Hust.																	
G. angustatum (Kütz.) Rabh.	qc	c	c	r	qc	c	vr	r	vr								
G. angustatum v. *producta* Grun.	vr	vr		vr	vr	qc											
G. bohemicum Reich. & Fricke																	
G. constrictum Ehr.		r	vr	vr	vr												
G. clevei Fricke																	
G. constrictum v. *capitata* (Ehr.) Cleve					vr	vr											
G. grovei M. Schm.			vr		vr			vr									
G. gracile Ehr.	vr	r	r	vr	vr	c	vr	r			vr						vr
G. gracile v. *cymbelloides* Grun.																	
G. intricatum Kütz.						vr											
G. intricatum v. *dichotomum* (Kütz.) Grun.				vr			vr										
G. lanceolatum Ehr.	vr	c			vr	r											
G. longiceps v. *subclavata* Grun.																	
G. lanceolatum v. *insignis* (Greg.) Cleve						vr											
G. olivaceum (Lyngb.) Kütz.	c	vc	vc	c	c	vc	qc	c	c						vr		
G. olivaceum v. *minutissima* Hust.	r	qc	qc	r	r	r		vr									
G. olivaceum v. *calcarea* Cleve	r	qc	r	r	r	vr			r								

Table 2 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
G. parvulum (Kütz.) Kütz.		qc				vr											
G. subclavatum Grun.																	
G. sphaerophorum Ehr.						vr											
G. tergestinum (Grun.) Fricke						r											
Gomphonema sp. #2																	
Gomphonema sp. #3			vr														
Gomphonema sp. #10																	
Gomphonema spp.		r	vr														
Genus *Navicula* Bory	0.84	1.27	0.63	0.09	0.06	1.34	1.06	1.05	0.50				0.17				
N. anglica Ralfs						r	vr	vr									
N. anglica v. *subsalsa* (Grun.) Cleve	vr	r	r			vr		vr									
N. anglica v. *signata* Hust.					r	vr	vr	vr									
N. aurora Sov.							vr	vr	vr								
N. bacillum Ehr.																	
N. capitata Ehr.	vr	qc	c	vr	r	c		vr	vr								
N. capitata v. *hungarica* (Grun.) Ross	vr	vr		vr	vr	r	vr	r	r								
N. capitata v. *luneburgensis* (Grun.) Patr.					vr	r	r	r	vr				r				
N. cuspidata Kütz.		r	vr			qc			vr								
N. cuspa Hohn																	
N. cincta (Ehr.) Ralfs	vr																
N. clementis Grun.					vr	vr		vr									
N. clementis v. *linearis* Brander						vr											
N. clementis v. *quadrisignata* Mang.				vr	r		vr	vr									
N. costulata Grun.		vr		vr	r	r		r	r				vr				
N. contenta v. *biceps* (Arn.) V.H.																	

Table 2 (cont.)

MONTH	August 1969																
STATION		FP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
N. confervacea (Kütz.) Grun.		r	vr			r	vr	vr	vr								
N. cruciculа (W. Sm.) Donk.																	
N. cuspidata v. *obtusa* Patr.																	
N. cymbalis Patr.																	
N. cryptocephala Kütz.	vr	c	vr	vr	r	c			r								
N. cryptocephala v. *intermedia* Grun.	vr	c	qc	r	r	c		r	r								
N. cryptocephala v. *veneta* (Kütz.) Rabh.		qc	r		r	r		vr	vr								
N. decussis Øst.	r	c	c	qc	qc	vc	qc	qc	qc		vr		vr		vr	vr	
N. elginensis (Greg.) Ralfs						vr											
N. elginensis v. *rostrata* (A. Mayer) Patr.																	
N. exiguaformis Hust.																	
N. exigua Greg. ex Grun.																	
N. explanata Hust.																	
N. gastrum (Ehr.) Kütz.	qc	c	c	r	r	c	vr	r	vr					vr			
N. gastrum v. *signata* Hust.		vr	vr				vr	r									
N. gregaria Donk.	vr	c	r		r	c		vr	vr								
N. gastriformis Hust.			vr	vr													
N. grimmei Krasske		r	vr			r	vr										
N. globosa Meist.																	
N. heufleri Grun.	r	qc	vr			c	vr										
N. hassiaca Krasske																	
N. integra (Wm. Smith) Ralfs	vr	r	vr			r	vr										
N. ingenua Hust.						r											
N. insignita Hust.																	
N. imbricata Bock		qc	r														
N. lacustris Greg.		vr	vr														
N. latens Krasske			vr	r	r	vc	qc	qc	qc		vr						
N. lanceolata (Agardh) Kütz.	vr	vc	c	vr	r	qc	vr		vr								

Table 2 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
N. *menisculus* Schum.																	
N. *menisculus* v. *upsaliensis* Grun.	r	r		r	r	vc		qc	qc								
N. *mutica* v. *tropica* Hust.		vr	vr														
N. *mutica* v. *cohnii* (Hilse) Grun.		r				r	vr	vr									
N. *minima* Grun.																	
N. *oblonga* (Kütz.) Kütz.		r		vr		vr											
N. *odiosa* Wallace																	
N. *oppugnata* Hust.																	
N. *paludosa* Hust.	vr	c			r	qc		vr									
N. *paratomus* Hust.	vr	vr	vr	vr	vr	vr											
N. *placentula* (Ehr.) Kütz.																	
N. *placentula* v. *rostrata* A. Mayer																	
N. *platystoma* v. *pantocsekii* Wisl. and Kolbe					r	r	r	r									
N. *platystoma* Ehr.				vr	vr		r	r	vr								
N. *protracta* Grun.																	
N. *protracta* v. *elliptica* Gallik						r			vr								
N. *peregrina* (Ehr.) Kütz.	vr	r	vr	vr	vr	r	vr	r	vr								
N. *pupula* Kütz.	vr				vr												
N. *pupula* v. *capitata* Skv. and Meyer	r	c	qc	vr	r	qc	vr	r	vr								
N. *pupula* v. *rectangularis* (Greg.) Grun.						vr											
N. *pupula* v. *mutata* (Krasske) Hust.		vr		vr	r	vr											
N. *pupula* v. *rostrata* Hust.				r	r	r		r	r								
N. *pygmaea* Kütz.		vr	vr	vr		vr											
N. *radiosa* Kütz.	vr	vr	qc	vr													
N. *radiosa* v. *parva* Wallace		r															

Table 2 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
N. radiosa v. *tenella* (Bréb.) Grun.	vr	qc	vr			r											
N. reinhardtii (Grun.) Grun.		vr				vr											
N. reinhardtii v. *elliptica* Herib.			vr			vr	vr										
N. rhynchocephala Kütz.			vr														
N. rhynchocephala v. *germainii* (Wallace) Patr.																	
N. rhynchocephala v. *amphiceros* (Kütz.) Grun.																	
N. rotunda Hust.	vr					vr											
N. subminima Patr. ?					vr	vr											
N. scutelloides Wm. Smith	r	qc	vr		r	qc		r	vr								
N. schroeteri v. *escambia* Patr.																	
N. seminulum Grun.					vr	vr											
N. simplex Krasske																	
N. strosei A. Cl.																	
N. symmetrica Patr.																	
N. tantula Hust.																	
N. tenera Patr. ?																	
N. tripunctata (O.F. Mull.) Bory	c	vc	vc	qc	qc	vc	vr	qc	qc						vr	vr	vr
N. tripunctata v. *cuneata* Lauby		r	vr		vr	r			vr								
N. tripunctata v. *schizonemoides* (V.H.) Patr.	r	c	c	vr	vr	qc											
N. tuscula Ehr.						vr	vr		vr								
N. tuscula fo. *obtusa* Hust.					vr												
N. tuscula fo. *rostrata* Hust.																	
N. vanheurckii Patr.					vr												
N. variostriata Krasske																	
N. viridula (Kütz.) Kütz.	c	c	vc	r	vr	vc	vr	vr									
N. viridula v. *avenacea* (Bréb.) V.H.	vr	r	vr			r		vr									

Table 2 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
N. viridula v. *linearis* Hust.	vr	r	vr														
N. viridula v. *rostellata* (Kütz.) Cleve	vr	r	vr		vr	qe											
N. vulpina Kütz.																	
N. wittrockii (Lagerstedt) A.Cl.						r											
Navicula sp. (*pygmaea* v. *producta*)	r	c	c	vr	r	qe		vr	r								
Navicula sp. #8 (*aff. lanceolata*)																	
Navicula sp. #18																	
Navicula sp. #19																	
Navicula sp. #22																	
Navicula sp. #23																	
Navicula sp. #25																	
Navicula sp. #27																	
Navicula sp. #36					vr												
Navicula sp. #38																	
Navicula sp. #40	vr	r			vr				vr								
Navicula sp. #43					vr	r											
Navicula sp. #44																	
Navicula sp. "A"					r	r	r	r	r								
Navicula sp.																	
Navicula sp.																	
Navicula sp.																	
Navicula sp.						r											
Navicula sp.																	
Navicula sp.																	
Navicula sp.																	
Genus *Nitzschia* Hass.	2.01	2.73	2.08	0.22	2.36	2.04	2.75	1.15	1.47				2.61			3.09	0.86
N. acicularis (Kütz.) Wm. Smith		r	r	vr	r	qe			r				c				

Table 2 (cont.)

MONTH	August 1969															
STATION	PP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
N. acuminata (Wm. Smith) Grun.																
N. acuta Hantz.		qc														
N. amphibia Grun.	r	c	qc	r	r	c	qc	r	r							
N. amphibia v. *fossilis* Grun.																
N. angustata (Wm. Smith) Grun.																
N. angustata v. *acuta* Grun.			vr													
N. apiculata (Greg.) Grun.	r	r				r			vr							
N. bacata Hust.	vr	vc	vc	vr	c	vc		vr	vr							
N. capitellata Hust.	qc	c	c	r	c	c										
N. commutata Grun.																
N. confinis Hust.																
N. denticula Grun.	vr															
N. dissipata (Kütz.) Grun.		qc	r	r	c	vc		qc	qc							
N. dissipata v. *media* (Hantz.) Grun.																
N. fonticola Grun.		qc	r	vr	r	qc										
N. frustulum (Kütz.) Grun.																
N. frustulum v. *perminuta* Grun.			vr		r											
N. frustulum v. *perpusilla* (Rabh.) Grun.																
N. hungarica Grun.	vr	c	c	r		c			vr							
N. holsatica Hust.																
N. interrupta (Reich.) Hust.																
N. inconspicua Hust.																
N. linearis Wm. Smith	qc	c	c	vr	qc	c			vr							
N. palea (Kütz.) Wm. Smith	qc	vc	c	r	c	vc		vr	qc							
N. parvula Wm. Smith	vr					vr		vr	vr							
N. recta Hantz.		vr	vr		vr	qc	qc	qc	qc							
N. romana Grun.									vr							
N. sigmoidea (Kütz.) Wm. Smith		r	vr			vr		vr								
N. sigma (Kütz.) Wm. Smith																

Table 2 (cont.)

MONTH	August 1969																
STATION	FP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
N. epiculoides Hust.		e															
N. sublinearis Hust.																	
N. subtilis (Kütz.) Grun.																	
N. stagnorum Rabh.																	
N. thermalis (Ehr.) Auersv.	r	r	r		r	r											
N. thermalis v. *intermedia* Grun.																	
N. thermalis v. *minor* Hilse																	
N. tryblionella Hantz.		qc	r			vr	vr	vr					vr				
N. tryblionella v. *debilis* (Arn.) A. Mayer																	
N. tryblionella v. *levidensis* (Wm. Smith) Grun.	r		r	vr	r	c		vr									
N. tryblionella v. *victoriae* Grun.		vr	r		vr	r		vr									
N. woltereckii Hust.	vc	vc	vc	qc	c	vc	vr	vr	qc								
Nitzschia sp. "A"	qc	vc	c	qc	c	vc	qc	qc	qc								
Nitzschia sp. "B"																	
Nitzschia sp. #1																	
Nitzschia sp. #2	qc	qc	c	qc	c	vc	qc	qc	qc				qc			c	r
Nitzschia sp. #6				vr	qc	r	vr	vr	vr								
Nitzschia sp. #7				vr													
Nitzschia sp. #8									r								
Nitzschia sp. #9																	
Nitzschia sp.	vr		vr														
Nitzschia sp.																	
Nitzschia sp.																	
Nitzschia spp.																	
Genus *Synedra* Ehr.	0.14	1.25	0.84	1.21	0.38	1.60	0.11	0.48	0.57				0.11				0.43
S. acus Kütz.	r	vc	c	e	qc	vc	vr	r	r				vr	vr		vr	
S. amphicephala Kütz.																	

Table 2 (cont.)

MONTH	August 1969																
STATION		PP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	19	26
S. capitata Ehr.																	
S. delicatissima Wm. Smith				vr	r	c											
S. delicatissima v. *angustissima* Grun.	r	vc	qc	vr	r	c		vr									
S. demerarae Grun.																	
S. fasciculata (Agardh) Kütz.		vr	vr		vr	r											
S. filiformis Grun.																	
S. filiformis v. *exilis* A.Cl.					vr												
S. minuscula Grun.																	
S. osterfeldii (Krieg.) A.Cl.					vr												
S. parasitica (W. Smith) Hust.	vr	vr		r		r											
S. parasitica v. *subconstricta* (Grun.) Hust.	r		r			qc			vr								
S. pulchella Ralfs		vr	vr	vr		vr											
S. pulchella v. *lanceolata* O'Meara																	
S. pulchella v. *lacerata* Hust.																	
S. rumpens Kütz.																	
S. rumpens v. *fragilarioides* Grun.																	
S. tenera Wm. Smith																	
S. ulna (Nitz.) Ehr.	r	vc	c	vr	r	vc	qc	qc	qc				vr		vr		
S. ulna v. *chaseana* Thomas	vr	vr			vr			vr	vr								
S. ulna v. *contracta* Østr.	vr	qc	r		vr	vr										vr	r
S. ulna v. *constricta* Venkt.	vr	r		vr	vr	r											
S. ulna v. *claviceps* Hust.		c	r	vr	r	c											

Table 2 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
S. ulna v. *danica* (Kütz.) V.H.																	
S. ulna v. *longissima* (Wm. Smith) Brun											vr						r
S. ulna v. *subaequalis* (Grun.) V.H.																	
S. ulna v. *spathulifera* (Grun.) V.H.	qc	vc	vc	vc	c	vc	qc	qc	qc								
S. ulna v. *oxyrhynchus* (Kütz.) V.H.																vr	
Synedra sp. (*vaucheriae* v. *fragilarioides*)	r	c	c	vc	qc	vc	qc	qc	qc								
Synedra sp. (*capitata* v. *fragilis*)						vr			vr					vr			r
Synedra sp. "A"	vr																
Genus *Tabellaria* Ehr.	0.02	vr	vr	0.09	0.19	0.44	0.53	1.05	0.08		0.58	0.24	2.22	0.02		4.06	24.35
T. fenestrata (Lyngb.) Kütz.	0.02	vr	vr	0.09	0.19	0.38	0.53	1.05	0.08		0.58	0.24	2.22	0.02		4.06	24.35
T. fenestrata v. *geniculata* A.Cl.																	
T. flocculosa (Roth) Kütz.						0.06											
Amphiprora ornata Bail.						vr			vr								
Amphipleura pellucida (Kütz.) Kütz.	vr																
Anomoeoneis sphaerophora (Ehr.) Pfitz.																	
Bacillaria paxillifer (O.F. Müll.) Hendy		c	r		vr	vr											

Table 2 (cont.)

MONTH	August 1969																
STATION		PP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
Caloneis amphisbaena (Bory) Cleve		qe	qe	vr	vr	r		vr	vr								
C. bacillum (Grun.) Cleve						vr											
C. bacillaris v. *thermalis* (Grun.) A.Cl.																	
C. bacillum v. *lancettula* (Schulz) Hust.																	
C. lewisii Patr.																	
C. ventricosa (Ehr.) Meist.																	
C. ventricosa v. *truncatula* (Grun.) Meist.					vr	r	e	e	qe								
C. ventricosa v. *subundulata* (Grun.) Patr.																	
Cymatopleura elliptica (Bréb. & Godey) Wm. Smith						vr											
C. solea (Bréb. & Godey) Wm. Smith		r	qe	vr	vr	qe	r	r	r							vr	
C. solea v. *apiculata* (Wm. Smith) Ralfs			vr			r		r	vr							vr	
Denticula tenuis v. *crassula* (Näg.) Hust.																	
Diploneis puella (Schum.) Cleve		vr				r	r	r									
D. pupula (Schmidt) Cleve?																	vr
D. subovalis Cleve																	
Diploneis sp. #1																	
Diploneis sp.																	
Diploneis sp.																	

Table 2 (cont.)

MONTH	August 1969																
STATION		FP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
Epithemia argus (Ehr.) Kütz.		vr	vr														
E. intermedia Fricke																	
E. sorex Kütz.						vr											
E. turgida (Ehr.) Kütz.																	
E. zebra (Ehr.) Kütz.									vr								
E. zebra v. *porcellus* (Kütz.) Grun.						vr											
Epithemia sp.	vr	vr	r														
Eunotia arcus Ehr.																	
E. arcus v. *bidens* Grun.																	
E. curvata (Kütz.) Lagerst.		vr				r	vr										
E. formica Ehr.		vr		vr													
E. pectinalis v. *minor* (Kütz.) Rabh.		vr															
E. pectinalis v. *ventricosa* Grun.					vr												
E. vanheurckii Patr.																	
Eunotia sp.								vr									
Frustulia rhomboides v. *amphipleuroides* (Grun.) Cleve																	
F. vulgaris (Thw.) DeToni		vr	vr					vr									
F. weinholdii Hust.						vr											
Frustulia sp.																	
Gyrosigma acuminatum (Kütz.) Rabh.																	
G. attenuatum (Kütz.) Rabh.		r	r			vr	vr	vr	vr								
G. spencerii v. *curvula* (Grun.) Reim.			vr		vr	vr	vr		vr								
G. scalproides (Rabh.) Cleve			vr			r	vr										
G. wormleyi (Sulliv.) Boyer						vr											
Gyrosigma sp.																	

Table 2 (cont.)

MONTH STATION DEPTH, METERS	PP 1	PP 6	PP 8	MP 1	MP 5	MP 9	August 1969 EP 1	EP 5.5	EP 7	LAKE(1) 1	LAKE(1) 5	LAKE(1) 11	LAKE(1) 16.5	LAKE(2) 1	LAKE(2) 5	LAKE(2) 18	LAKE(2) 26
Hantzschia amphioxys (Ehr.) Grun.			vr														
Nitzschia gracilis W. Smith																	
N. smithii Thw.																	
N. smithii v. *lacustris* Grun.	vr	vr	vr			r											
Meridion circulare (Grev.) Agardh.	vr	c	r	vr	vr	c	vr		r								
M. circulare v. *constrictum* (Ralfs) V.H.						vr											
Neidium affine (Ehr.) Pfitz.																	
N. bisulcatum (Ehr.) Hust.																	
N. dubium (Ehr.) Cleve		r	r			vr	r										
N. dubium fo. *constrictum* Hust.																	
N. iridis (Ehr.) Cleve						vr											
N. iridis v. *amphigomphus* (Ehr.) A. Mayer			vr														
N. productum (Wm. Smith) Cleve																	
N. temperei Reim.																	
Neidium sp. #3								r	c								
Neidium sp.							vr										
Costrupia zachariasi (Reich.) Stoermer																	
O. zachariasi v. *undulata* (Schulz) Stoermer					vr												
Opephora martyi Hérib.	c	c	c	vr	r	c	r	cc	vr								
Pinnularia abaujensis (Pant.) Ross																	
P. acrosphaeria Wm. Smith																	
P. biceps Greg.			vr														
P. biceps fo. *petersenii* Ross		vr															

Table 2 (cont.)

MONTH STATION DEPTH, METERS	FP 1	 6	 8	MP 1	 5	 9	August 1969 EP 1	 5.5	 7	LAKE(1) 1	 5	 11	 16.5	LAKE(2) 1	 5	 18	 26
P. brebissonii (Kütz.) Rabh.	vr	vr	r		vr	vr	vr		vr								
P. borealis Ehr.			vr														
P. burkii Patr.																	
P. intermedia (Lagerst.) Cleve																	
P. leptosoma (Grun.) Cleve	vr	vr	vr			vr	vr			vr							
P. obscura Krasske																	
P. rupestris Hantz.		vr															
Pinnularia sp.																	
Rhoicosphenia curvata (Kütz.) Grun.	c	vc	vc	vc	vc	vc	c	vc	vc				vr				vr
Rhopalodia gibba (Ehr.) O. Müll.	vr	cc	vr	vr	vr	r	vr		vr								
Rh. gibberula (Ehr.) O. Müll.		vr															
Stauroneis acutinuscula Pereg. & Hérib.							vr	vr	vr								
S. anceps fo. *gracilis* Rabh.																	
S. anceps fo. *linearis* (Ehr.) Hust.																	
S. phoenicenteron (Nitz.) Ehr.																	
S. phoenicenteron fo. *gracilis* (Ehr.) Hust.																	
S. kriegeri Patr.																	
S. smithii Grun.																	
Stauroneis sp.		vr															
Surirella angustata Kütz.	vr				vr	vr			vr								
S. linearis Wm. Smith																	
S. linearis v. *constricta* (Ehr.) Grun.					vr	vr	vr	r	vr								
S. ovata Kütz.		c	vr	vr	vr	r			vr								
S. ovata v. *pinnata* (Wm. Smith) Hust.		r															
S. robusta v. *splendida* (Ehr.) V.H.																	
Surirella sp.																	
Tropidoneis lepidoptera v. *proboscidea* Cleve	vr		vr			vr											

TABLE 3. ESTIMATED NUMBERS OF GREENS, BLUEGREENS, CHRYSOPHYTA, PYRROPHYTA AND FLAGELLATES.

Units in 1 ml of Sample.

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE (5)		LAKE (1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
TOTAL GREENS	1509	538	718	386	92	119	229	250	46	41	42	1489	1241	420	568	322	231	43	45
Actinastrum hantzschii Lag.	32	6	15	7	2	1	6	4											
Ankistrodesmus braunii (Näg.) Brunnthaler												142	63	11	4	38	12		
A. convolutus Corda																			
A. falcatus (Corda) Ralfs	183	63	57	49	9	10	28	25	2	2	2	150	162	68	74	47	21	5	4
A. falcatus v. *mirabilis* (West & West) G.S. West																			
Ankistrodesmus spp.	65	2	116	62	2	2	18	3				3	5				3		
Characium sp.												4	11	3		4	1		
Chlorococcum sp.																			
Chlorella vulgaris Beyerinck																	5		
Closteriopsis longissima Lemm.	8	3	7	4	1	0.3		1											
Closterium sp.											0.3	15	15		30	1	2	0.3	
Coelastrum cambricum Arch.											0.3	5			11				0.6
C. microporum Näg.	42	33	4		1	5	3	18											
C. reticulatum (Dang.) Senn	18	14	2			1	2	4											
C. sphaericum Näg.	5	3	3			1	1	3		1									
Coelastrum sp.												7		16	4	2	7	0.3	
Cosmarium spp.	7		5		2	2			0.6	0.3	0.3								
Crucigenia apiculata (Lemm.)	13	4	8	2	0.4	3		1	2	0.6	1	2	4		11			0.3	1
Schmidle								4		0.6									
C. irregularis Wille												16		7	3		15	1	1
C. lauterbornii Schmidle	6	8	7	1	2	1		2	0.3										
C. quadrata Morren	3	5	5	1		2		3	0.3										
C. rectangularis (A.Braun) Gay		1									1	33		7	12	5	5	1	2
C. tetrapedia (Kirch.) West & West		0.6				2			0.6	3	0.6								
C. truncata G.M. Smith				2				2			0.3						10		

(cont.)

Table 3 (cont.)

MONTH	September 1968											October 1968							
STATION	FP		MP		EP		LAKE (5)		LAKE (1)			FP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Desmatractum sp.	7						8								4			0.6	
Dictyosphaerium ehrenbergianum Näg.	18	7	4	1		3													
D. pulchellum Wood	33	6	13	5	2		6		0.3			129	11	32	19	6	12	4	1
Dimorphococcus lunatus A. Braun	17	28	15	9	3	3	2	5					74		19			0.3	
Dactylococcus infusionum Näg.		7																	
Elakatothrix gelatinosa Wille																			
E. viridis (Snow) Printz																			
Elakatothrix spp.																			
Euastropsis sp.																			
Excentrosphaera viridis Moore																			
Franceia droescheri (Lemm.) G.M. Smith		0.6		1															
F. ovalis (Francé) Lemm.				5												1			
Gloeocystis ampla (Kütz.) Lag.																			
G. gigas (Kütz.) Lag.																			
G. major Gerneck ex Lemm.		2																	
G. planktonica (West & West) Lemm.																			
G. vesiculosa Näg.																			
Gloeocystis sp.																			
Gloeocystis spp.	15		10		4		13		8	10		35	19	10	41	14	16	2	3
Golenkinia radiata (Chod.) Wille		0.6	2		2	1	12	1	0.3	0.3		7	4	5	19	3	1	0.3	0.3
Kirchneriella contorta (Schmidle) Bohlin							2	4						2					
K. elongata G.M. Smith					1							2					5		0.6
K. lunaris (Kirch.) Moeb.																			
K. obesa (W.West) Schmidle	11	3	17		5	4	5	2		0.3		1	4	2		1	6	0.3	
K. subsolitaria G.S. West												4							
Kirchneriella sp.																			

(cont.)

Table 3 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE (5)		LAKE (1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Lagerheimia ciliata (Lag.) Chod.																			
L. citriformis (Snow) G.M. Smith																			
L. longiseta (Lemm.) Printz			2	4	1	1				0.3		10	1		4	2			
L. quadriseta (Lemm.) G.M. Smith	4	3	5										3	2					
Lagerheimia sp.																			
Mougeotia sp.																			
Nephrocytium agardhianum Näg.	3	2	1	2					0.3										
N. limneticum (G.M. Smith) G.M. Smith	2	3	2	3															
N. obesum West & West	14	4	7	1		0.3	4	5		1						1			
Nephrocytium sp.										0.6									
Oedogonium sp.																			
Oocystis borgei Snow	16	30	18	3	5	2	1	7	6	4	2	6	5		2				1
O. crassa Wittrock	3	12	6					9			1								
O. elliptica W. West	2	2																	
O. eremosphaeria G.M. Smith	1	4				2		6	1								1		4
O. gigas Arch.	18	15	9																
O. gloeocystiformis Borge																			
O. lacustris Chod.		2		1	1	0.6	5	9			4				1				
O. nodulosa West & West																			
O. panduriformis West & West	4	9	2																
O. parva West & West			1	2					1						1			0.3	
O. pusilla Hansg.	2	4	1			0.3		5	0.3		1								
O. pyriformis Prescott	1	4	1			0.3													
O. solitaria Wittrock	130	29	13	19	8	15	7	19	9	10	8	99	148	47	63	46	17	6	12
O. submarina Lag.						1		1	5									0.3	
Oocystis sp.				2		1	5												
Oocystis spp.	35		2							2	6	21	32	5	15	12	6	9	3

(cont.)

Table 3 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE (5)		LAKE (1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Pediastrum biradiatum Meyen		6		2		1													
P. boryanum (Turp.) Menegh.	7	2	5			1		1											
P. duplex Meyen	44	9	8	7	1	2	6	4		0.3	1	47	7	2		3			1
P. integrum Näg.						0.3													0.3
P. obtusum Lucks	7		1																
P. simplex (Meyen) Lemm.	15	2	9	4		0.6	2	1	0.3			2				1			0.6
P. simplex v. *duodenarium* (Bailey) Rabenh.																			
P. tetras (Ehr.) Ralfs		4	3																
Pediastrum spp.			5		1									7	4	1		0.3	
Phaeococcus planctonicus West & West																			
Planktosphaeria gelatinosa G.M. Smith																			
Quadrigula chodatii (Tan.-Ful.) G.M. Smith	4					0.6								2					
Q. closteroides (Bohlin) Printz	7							1	0.3										
Q. lacustris (Chod.) G.M. Smith									0.6	0.6									
Quadrigula spp.																	1	0.3	
Scenedesmus abundans (Kirch.) Chod.	189	47	76	61	9	4	16	24	2			218	129	52	22	21	4	1	
S. abundans v. *brevicauda* G.M. Smith	8	3	7	3	2		1	2											
S. acuminatus (Lag.) Chod.					2			1							4		2		
S. acutiformis Schroed.	22	3	17	1	2				0.6			7	15	2					
S. arcuatus Lemm.		2		4		0.6												0.3	
S. arcuatus v. *platydiscus* G.M. Smith																			
S. armatus (Chod.) G.M. Smith												12	2	2		1			
S. armatus v. *major* G.M. Smith																			
S. bernardii G.M. Smith	4		1	3								20	1		4	3			
S. bijuga (Turp.) Lag.				2								10		15		4	2	0.6	

(Cont.)

Table 3 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		XP		LAKE (5)		LAKE (1)			PP		MP		XP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
S. bijuga v. *alternans* (Reinsch) Hansg.																			
S. denticulatus Lag.												7				1			
S. dimorphus (Turp.) Kütz.	48	68	29	11	2	9	9	6	0.3	0.6		37	45	12	7	4		1	1
S. incrassatulus Bohlin	63	4	34	12			4	5		0.3		74	108	22	22	24	19	0.3	
S. incrassatulus v. *mononae* G.M. Smith																			
S. longus v. *nägelii* (Bréb.)				2															
S. obliquus (Turp.) Kütz.														4					
S. opoliensis P. Richter	3	9	5	4								27	3		4	6			
S. opoliensis v. *contacta* Prescott																			
S. perforatus Lemm.																			
S. protuberans Fritsch																			
S. quadricauda (Turp.) Bréb.	152	36	46	65	10	20	30	26	0.6	2	2	214	226	60	108	45	36	2	4
S. quadricauda v. *longispina* (Chod.)	4		1			2										3			
S. quadricauda v. *maximus* West & West	49	7	21	9	5	7	22	19	1			31	22	4	7	1	9	0.3	1
S. quadricauda v. *westii* G.M. Smith					1														
Scenedesmus sp.																			0.6
Scenedesmus sp. #1							7						4				1		
Scenedesmus sp. #2													4						
Scenedesmus sp. #3													4						
Scenedesmus spp.											4								
Schizochlamys compacta Prescott																			
S. gelatinosa A. Braun																			
Schroederia judayi G.M. Smith	7			2															
S. setigera (Schroed.) Lemm.																			
Schroederia sp.																			
Selenastrum gracile Reinsch																			
Selenastrum sp.	8					1													
Sorastrum americanum (Bohlin) Schmidle																			
S. spinulosum Näg.																			

(cont.)

Table 3 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE (5)		LAKE (1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Sphaerocystis schroeteri Chod.																			
Staurastrum spp.	7		8		0.4		6	4				5	4						
Tetradesmus smithii Prescott																			
T. wisconsinense G.M. Smith																			
Tetraëdron caudatum (Corda) Hansg.	11	2	5	2		2	2	2				20	26	7	4	4	2		0.3
T. lunula (Reinsch) Wille								1				40	41	2	17	7	2	2	1
T. minimum (A. Braun) Hansg.		7	5	6	4	2	2	6	2	0.6	2	10	15	8	11	4	1	4	2
T. muticum (A. Braun) Hansg.																2	1		
T. regulare Kütz.																			
T. trigonum (Näg.) Hansg.	7		5		0.4				0.6			15	15	2	7	4	6	0.3	
T. pentaedricum West & West																			
Tetraëdron sp.																			
Tetrastrum staurogeniaeforme (Schroed.) Lemm.																			
Tetrallantos lagerheimii Teiling?																			
Treubaria setigerum (Arch.) G.M. Smith																			
Ulothrix sp.																			
Westella botryoides (W. West) Wildemann																			
W. linearis G.M. Smith																			
Westella sp.																			
Undetermined green colony	7	9						4			6								
Undetermined green cells	118		67										11		15				
Colonial desmid																			
GREENS, percent composition in total phytoplankton	9.34	8.90	7.18	5.98	6.27	6.51	5.26	7.48	7.64	8.23	4.88	8.66	8.43	7.15	9.04	9.35	9.59	4.59	4.14

(cont.)

Table 3 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE (5)		LAKE (1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
TOTAL BLUE-GREENS	122	9	41	53	11	16	72	42	30	31	49	29	17	17	29	19	23	17	17
Anabaena circinalis Rabenh.			2		1	1	2	1	1	0.3	2					1	2	2	2
Anabaena spp.									1								3		
Anacystis spp.																			
Aphanizomenon flos-aquae (L.) Ralfs						0.6											1		2
Aphanocapsa pulchra (Kütz.) Rabenh.																		0.6	
Aphanocapsa spp.				7	3	4	41	9	5	15	23			5	10	11	9	11	7
Asterococcus limneticus G.M. Smith						1													
Chroococcus limneticus Lemm.	7			7	3	1	7	3	21	13	13					1	5	1	
Ch. minutus (Kütz.) Näg.						1													1
Ch. prescottii Drouet & Daily																			0.3
Ch. turgidus (Kütz.) Näg.																			
Chroococcus spp.											2							0.3	
Coelosphaerium nägelianum Unger																			0.3
Dactylococcopsis smithii Chod. & Chod.												7							2
Gomphosphaeria aponina Kütz.																			
G. lacustris Chod.	4					1													
Holopedium irregulare Lag.						0.3													
Merismopedia elegans v. *major* G.M. Smith											4								
M. tenuissima Lemm.																			
Microcystis aeruginosa Kütz.				2		1													
Oscillatoria spp.	2	9	1			1	4	4		0.6	5		7	5		3	1	1	1
Phormidium spp.	109		38	37	4	4	18	25	2	2		22	10	7	19	3	2	0.9	1
BLUE-GREENS, percent composition in total phytoplankton	0.76	0.15	0.41	0.82	0.78	0.90	1.66	1.26	5.04	6.25	5.70	0.17	0.12	0.29	0.47	0.56	0.96	1.81	1.61

(cont.)

Table 3 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE (5)		LAKE (1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
TOTAL CHRYSOPHYTA		5		63	14	65	76	122	7	9		10	4	24	37	34	14	11	10
Centritractus belonophorus Lemm.		3		4			4	1					4						
Dinobryon bavaricum Imhof				20	2	32	35	39	2	2					4				
D. calciformis Bachmann																			
D. divergens Imhof		2		35	12	33	37	82	5	7								1	
Mallomonas spp.														22	33	34	14	10	10
Ophiocytium capitatum v. *longispinum* (Moeb.) Lemm.												10		2					1
Ophiocytium sp.				4															
Tribonema sp.																			
CHRYSOPHYTA, percent composition in total phytoplankton		0.09		0.98	0.95	3.55	1.75	3.66	1.26	1.85		0.06	0.03	0.42	0.59	0.98	0.56	1.16	0.98
TOTAL PYRROPHYTA	45	2	20	42	5	11	37	13	9	4	1			22	3	2	3	3	1
Ceratium hirundinella (O.F. Müll.) Dujardin						1			4	2									
Cystodinium sp	7																		
Glenodinium spp.				2		3								17					
Peridinium spp.	38	2	20	41	5	7	37	13	5	2	1								
Dinoflagellate cysts														5	3	2	3	3	1
PYRROPHYTA, percent composition in total phytoplankton	0.28	0.03	0.20	0.66	0.38	0.62	0.85	0.41	1.61	0.98	0.14			0.35	0.05	0.07	0.14	0.32	0.13
TOTAL FLAGELLATES	467	100	270	151	73	10	141	77	109	71	179	397	266	183	308	275	192	220	326
Chlamydomonas sp.			139	34	56	4	93	56	80	47	137	3	63	98	174	208	166	231	311
Cryptomonas sp.	394	74	119	78	14	7	41	21	29	24	42	318	185	65	96	56	17	17	15
Euglena spp.	30	22		37	2							38	11	8	12	7	2		0.3
Lepocinclis spp.	7											6		1	21		1		

(cont.)

Table 3 (cont.)

MONTH	September 1968											October 1968							
STATION	PP		MP		EP		LAKE (5)		LAKE (1)			PP		MP		EP		LAKE	
DEPTH, METERS	1	6.6	1	6	1	6.6	1	8	1	10	17	1	7.5	1	7	1	6.6	1	9
Pteromonas sp.	36	4	12	2	1		7												
Phacus sp.												11	7	7	2	1	4	2	
Undetermined flagellates												21		4	3	3	1		
FLAGELLATES, percent composition in total phytoplankton	2.89	1.66	2.70	2.35	4.97	0.59	3.24	2.33	18.24	14.26	20.87	2.31	1.81	3.12	4.90	8.00	7.93	23.09	29.94

Table 3 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
TOTAL GREENS	333	413	56	50	135	27	117	43	45	38	115	68	20	54	67
Actinastrum hantzschii Lag.				2											0.5
Ankistrodesmus braunii (Näg.) Brunnthaler															
A. convolutus Corda															
A. falcatus (Corda) Ralfs	76	42	11	6	19	10	7	9	4	17	18	3	1	4	5
A. falcatus v. *mirabilis* (West & West) G. S. West															
Ankistrodesmus spp.														8	
Characium sp.							5								
Chlorococcum sp.															
Chlorella vulgaris Beyerinck															
Closteriopsis longissima Lemm.		5	0.6	1	1		2			1	4			0.3	3
Closterium sp.				1			1						0.4	0.3	0.5
Coelastrum cambricum Arch.															
C. microporum Näg.															
C. reticulatum (Dang.) Senn							1						0.4		
C. sphaericum Näg.															
Coelastrum sp.								1							
Cosmarium spp.		3		3			62	3			6	1	1	3	0.5
Crucigenia apiculata (Lemm.) Schmidle		3			1		1						2	1	2
C. irregularis Wille															
C. lauterbornii Schmidle															
C. quadrata Morren															
C. rectangularis (A. Braun) Gay			3					1				38			0.4
C. tetrapedia (Kirch.) West & West															
C. truncata G. M. Smith															

(cont.)

Table 3 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
Desmatractum sp.															
Dictyospherium ehrenbergianum Näg.															
D. pulchellum Wood		10	0.6		4	1		1	2	3	4	2		3	4
Dimorphococcus lunatus A. Braun								3			4				
Dactylococcus infusionum Näg.															
Elakatothrix gelatinosa Wille															
E. viridis (Snow) Printz															
Elakatothrix spp.															
Euastropsis sp.															
Excentrosphaera viridis Moore															
Franceia droescheri (Lemm.) G.M. Smith			0.6					1							
F. ovalis (Francé) Lemm.															
Gloeocystis ampla (Kütz.) Lag.							1								
G. gigas (Kütz.) Lag.							1								
G. major Gerneck ex Lemm.															
G. planktonica (West & West) Lemm.				1											
G. vesiculosa Näg.															
Gloeocystis sp.												2	0.4		0.5
Gloeocystis spp.															
Golenkinia radiata (Chod.) Wille	3								2			0.3			1
Kirchneriella contorta (Schmidle) Bohlin															
K. elongata G.M. Smith															
K. lunaris (Kirch.) Moeb.													1		
K. obesa (W. West) Schmidle															
K. subsolitaria G.S. West															
Kirchneriella sp.	3	3	0.6		1		1				2			0.6	

(cont.)

Table 3 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
Lagerheimia ciliata (Lag.) Chod.															
L. citriformis (Snow) G.M. Smith															
L. longiseta (Lemm.) Printz															
L. quadriseta (Lemm.) G.M. Smith															1
Lagerheimia sp.					2					1	3			0.4	
Mougeotia sp.				2			10								
Nephrocytium agardhianum Näg.															
N. limneticum (G.M. Smith) G.M.Smith															
N. obesum West & West															1
Nephrocytium sp.															
Oedogonium sp.															
Oocystis borgei Snow	5	8	2		2			1		1	2	1		2	1
O. crassa Wittrock													1		
O. elliptica W. West															
O. eremosphaeria G.M. Smith															
O. gigas Arch.															
O. gloeocystiformis Borge															
O. lacustris Chod.															
O. nodulosa West & West												0.3		1	
O. panduriformis West & West															
O. parva West & West												0.3			
O. pusilla Hansg.												2		1	1
O. pyriformis Prescott															
O. solitaria Wittrock	78	121	17	9	16		3	2		3	18	6	4	9	13
O. submarina Lag.				1								0.6	5	2	0.5
Oocystis sp.															
Oocystis spp.	31	24	13	3	4	12	7	13	25	6	10	6		1	5

(cont.)

Table 3 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
Pediastrum biradiatum Meyen															
P. boryanum (Turp.) Menegh.															
P. duplex Meyen												1			
P. integrum Näg.															
P. obtusum Lucks															
P. simplex (Meyen) Lemm.				1				1							0.5
P. simplex v. *duodenarium* (Bailey) Rabenh.															
P. tetras (Ehr.) Ralfs															
Pediastrum spp.	10					3								0.3	0.5
Phacotococcus planctonicus West & West															
Planktosphaeria gelatinosa G.M. Smith															
Quadrigula chodatii (Tan.-Ful.) G.M. Smith															
Q. closteroides (Bohlin) Printz															
Q. lacustris (Chod.) G.M. Smith													0.4		
Quadrigula spp.			0.6					3	6						
Scenedesmus abundans (Kirch.) Chod.	8	15			10		3						1	6	6
S. abundans v. *brevicauda* G.M. Smith															
S. acuminatus (Lag.) Chod.															
S. acutiformis Schroed.		3													0.5
S. arcuatus Lemm.															
S. arcuatus v. *platydisca* G.M. Smith															
S. armatus (Chod.) G.M. Smith	3			0.6									1		
S. armatus v. *major* G.M. Smith															
S. bernardii G.M. Smith															
S. bijuga (Turp.) Lag.					3										1

(cont.)

Table 3 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
S. bijuga v. *alternans* (Reinsch) Hansg.															
S. denticulatus Lag.				1	1		2								
S. dimorphus (Turp.) Kütz.	17	30	2	5	2				1	1	4	0.3		2	3
S. incrassatulus Bohlin	3	12	0.6		13						3	0.3		0.3	3
S. incrassatulus v. *mononae* G.M. Smith															
S. longus v. *nägelii* (Bréb.)															
S. obliquus (Turp.) Kütz.															
S. opoliensis P. Richter				3			1								2
S. opoliensis v. *contacta* Prescott															
S. perforatus Lemm.															
S. protuberans Fritsch															
S. quadricauda (Turp.) Bréb.	78	126	4	4	46		3	3	3	4	19	2		7	3
S. quadricauda v. *longispina* (Chod.)															
S. quadricauda v. *maximus* West & West	5	7	1	2	4					1	6			1	
S. quadricauda v. *westii* G.M. Smith															
Scenedesmus sp.															
Scenedesmus sp. #1															
Scenedesmus sp. #2															
Scenedesmus sp. #3															
Scenedesmus spp.															
Schizochlamys compacta Prescott															
S. gelatinosa A. Braun															
Schroederia judayi G.M. Smith				3			2						0.4		
S. setigera (Schroed.) Lemm.															
Schroederia sp.															
Selenastrum gracile Reinsch															
Selenastrum sp.															
Sorastrum americanum (Bohlin) Schmidle															
S. spinulosum Näg.							1								

(cont.)

Table 3 (cont.)

MONTH	November 1968														
STATION	FP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
Sphaerocystis schroeteri Chod.															
Staurastrum spp.	3						1								
Tetradesmus smithii Prescott															
T. wisconsinense G.M. Smith															
Tetraedron caudatum (Corda) Hansg.				1							2				0.5
T. lunula (Reinsch) Wille					5						7	1			6
T. minimum (A. Braun) Hansg.	3			1	1	1		1	2		2	1	1		0.5
T. muticum (A. Braun) Hansg.															
T. regulare Kütz.															
T. trigonum (Näg.) Hansg.	3										2			0.4	1
T. pentaedricum West & West															
Tetraedron sp.															
Tetrastrum staurogeniaeforme (Schroed.) Lemm.															
Tetrallantos lagerheimii Teiling?															
Treubaria setigerum (Arch.) G.M. Smith															
Ulothrix sp.							2								
Westella botryoides (W. West) Wildemann															
W. linearis G.M. Smith															
Westella sp.															
Undetermined green colony	5														
Undetermined green cells															
Colonial desmid															
GREENS, percent composition in total phytoplankton	5.66	6.36	2.21	3.48	3.63	1.22	5.07	1.57	2.81	1.64	3.39	5.95	2.84	3.14	2.65

(cont.)

Table 3 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
TOTAL BLUE-GREENS	37	27	52	10	10	46	18	39	23	25	8	22	11	7	9
Anabaena circinalis Rabenh.							3	1	4	3	1	0.3		1	1
Anabaena spp.													2		
Anacystis spp.															
Aphanizomenon flos-aquae (L.) Ralfs				2			1			3					
Aphanocapsa pulchra (Kütz.) Rabenh.															
Aphanocapsa spp.			8	3	1	1		5	5	6		8	4	4	3
Asterococcus limneticus G.M. Smith															
Chroococcus limneticus Lemm.			14	4		3	7	3	2		2	4	2		3
Ch. minutus (Kütz.) Näg.															
Ch. prescottii Drouet & Daily															
Ch. turgidus (Kütz.) Näg.												1			
Chroococcus spp.			26		1	1		4	1	8				0.3	
Coelosphaerium nägelianum Unger															
Dactylococcopsis smithii Chod. & Chod.												3			
Gomphosphaeria aponina Kütz.															
G. lacustris Chod.													1		0.4
Holopedium irregulare Lag.															
Merismopedia elegans v. *major* G.M. Smith								1							
M. tenuissima Lemm.															
Microcystis aeruginosa Kütz.															
Oscillatoria spp.	37	27	4		8	41	4	25	11	5	5	4		2	2
Phormidium spp.				1			3					2	2		
BLUE-GREENS, percent composition in total phytoplankton	0.63	0.42	2.05	0.71	0.28	2.11	0.80	1.45	1.47	1.08	0.24	1.93	1.58	0.45	0.37

(cont.)

Table 3 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
TOTAL CHRYSOPHYTA	2	2	5	4		2	15	3		3	2	1.5	0.5	3	1.5
Centritractus belanophorus Lemm.															
Dinobryon bavaricum Imhof															
D. calciformis Bachmann			1												
D. divergens Imhof	2	2	4	2		2		3		3	2	1		3	1
Mallomonas spp.				2			15						0.5		
Ophiocytium capitatum v. *longispinum* (Moeb.) Lemm.															
Ophiocytium sp.												0.5			0.5
Tribonema sp.															
CHRYSOPHYTA, percent composition in total phytoplankton	0.04	0.03	0.21	0.32		0.11	0.67	0.14		0.15	0.06	0.13	0.07	0.16	0.06
TOTAL PYRROPHYTA	2		1	1	2			3				1			
Ceratium hirundinella (O.F. Müll.) Dujardin															
Cystodinium sp.															
Glenodinium spp.															
Peridinium spp.	2		1	1	2			3				1			
Dinoflagellate cysts															
PYRROPHYTA, percent composition in total phytoplankton	0.04		0.04	0.06	0.05			0.09				0.08			
TOTAL FLAGELLATES	166	423	616	478	319	792	825	467	697	1092	545	442	367	96	77
Chlamydomonas sp.	32	324	548	423	237	708	733	386	674	990	490	420	330	61	68
Cryptomonas sp.	114	86	68	55	76	84	91	81	23	102	51	21	36	26	7
Euglena spp.		3										0.3			0.5
Lepocinclis spp.															

(cont.)

Table 3 (cont.)

MONTH	November 1968														
STATION	PP		MP			EP(1)			EP(2)			LAKE			
DEPTH, METERS	1	6.6	1	7	9	1	5	9	1	5	9	1	10	25	28
Pteromonas sp.	20	7			3		1				4	0.3	1		1
Phacus sp.		3			1							0.3			0.5
Undetermined flagellates					2									9	
FLAGELLATES, percent composition in total phytoplankton	2.82	6.52	24.03	33.23	8.57	35.62	35.65	17.25	43.48	47.00	16.06	38.64	49.93	5.60	3.04

(cont.)

Table 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
TOTAL GREENS	8	36	37	14	71	12	32	20	13	65	17	54	35	73	23	34	42	11
Actinastrum hantzschii Lag.																		
Ankistrodesmus braunii (Näg.) Brunnthaler																		
A. convolutus Corda																		
A. falcatus (Corda) Ralfs																		
A. falcatus v. mirabilis (West & West) G.S. West										14	7	37	29	70	22	33	36	7
Ankistrodesmus spp.	2	6	20	8	26	11	21	10										
Characium sp.																		
Chlorococcum sp.																		
Chlorella vulgaris Beyerinck																		
Closteriopsis longissima Lemm.		8																
Closterium sp.			1		1	0.7							3				3	
Coelastrum cambricum Arch.																		
C. microporum Näg.																		
C. reticulatum (Dang.) Senn																		
C. sphaericum Näg.																		
Coelastrum sp.																		
Cosmarium spp.	0.6				1													
Crucigenia apiculata (Lemm.) Schmidle																	1	
C. irregularis Wille																		
C. lauterbornii Schmidle																		
C. quadrata Morren																		
C. rectangularis (A. Braun) Gay																		
C. tetrapedia (Kirch.) West & West																		
C. truncata G.M. Smith																		

(cont.)

Table 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Desmatractum sp.																		
Dictyosphaerium ehrenbergianum Näg.																		
D. pulchellum Wood										2	2	1	2	1				
Dimorphococcus lunatus A. Braun																		1
Dactylococcus infusionum Näg.																		
Elakatothrix gelatinosa Wille																		
E. viridis (Snow) Printz																		
Elakatothrix spp.																		
Euastropsis sp.																		
Excentrosphaera viridis Moore																		
Franceia droescheri (Lemm.) G.M. Smith																		
F. ovalis (Francé) Lemm.																		
Gloeocystis ampla (Kütz.) Lag.																		
G. gigas (Kütz.) Lag.																		
G. major Gerneck ex Lemm.																		
G. planktonica (West & West) Lemm.																		
G. vesiculosa Näg.																		
Gloeocystis sp.																		
Gloeocystis spp.																		
Golenkinia radiata (Chod.) Wille																		
Kirchneriella contorta (Schmidle) Bohlin																		
K. elongata G.M. Smith																		
K. lunaris (Kirch.) Moeb.																		
K. obesa (W. West) Schmidle																		
K. subsolitaria G.S. West																		
Kirchneriella sp.																		

(cont.)

Table 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Lagerheimia ciliata (Lag.) Chod.																		
L. citriformis (Snow) G.M. Smith																		
L. longiseta (Lemm.) Printz																		
L. quadriseta (Lemm.) G.M. Smith																		
Lagerheimia sp.																		
Mougeotia sp.																		
Nephrocytium agardhianum Näg.																		
N. limeticum (G.M. Smith) G.M. Smith																		
N. obesum West & West																		
Nephrocytium sp.																		
Oedogonium sp.																		
Oocystis borgei Snow	0.6		2	2	2		1	2		2		1		1			2	2
O. crassa Wittrock																		
O. elliptica W. West																		
O. eremosphaeria G.M. Smith																		
O. gigas Arch.																		
O. gloeocystiformis Borge																		
O. lacustris Chod.																		
O. nodulosa West & West																		
O. panduriformis West & West																		
O. parva West & West																		
P. pusilla Hansg.																		
O. pyriformis Prescott																		
O. solitaria Wittrock	2	18	8	5	31		6	5	4	28		6		1				
O. submarina Lag.																		
Oocystis sp.																		
Oocystis spp.							4			2								

(cont.)

Table 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Pediastrum biradiatum Meyen																		
P. boryanum (Turp.) Menegh.																		
P. duplex Meyen											1	1						
P. integrum Näg.																		
P. obtusum Lucks																		
P. simplex (Meyen) Lemm.																		
P. simplex v. *duodenarium* (Bailey) Rabenh.																		
P. tetras (Ehr.) Ralfs																		
Pediastrum spp.											3							
Phaeococcus planctonicus West & West																		
Planktosphaeria gelatinosa G.M. Smith																		
Quadrigula chodatii (Tan.-Ful.) G.M. Smith																		
Q. closterioides (Bohlin) Printz																		
Q. lacustris (Chod.) G.M. Smith																		
Quadrigula spp.																		
Scenedesmus abundans (Kirch.) Chod.		4			6				4	6		1						
S. abundans v. *brevicauda* G.M. Smith																		
S. acuminatus (Lag.) Chod.																		
S. acutiformis Schroed.																		
S. arcuatus Lemm.																		
S. arcuatus v. *platydisca* G.M. Smith																		
S. armatus (Chod.) G.M. Smith																		
S. armatus v. *major* G.M. Smith																		
S. bernardii G.M. Smith																		
S. bijuga (Turp.) Lag.																		

(cont.)

Table 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
S. bijuga v. *alternans* (Reinsch) Hansg.																		
S. denticulatus Lag.																		
S. dimorphus (Turp.) Kütz.		2	3		2													1
S. incrassatulus Bohlin			1		1					2	1	2				1		
S. incrassatulus v. *mononae* G.M. Smith																		
S. longus v. *nägelii* (Bréb.)																		
S. obliquus (Turp.) Kütz.																		
S. opoliensis P. Richter																		
S. opoliensis v. *contacta* Prescott																		
S. perforatus Lemm.																		
S. protuberans Fritsch																		
S. quadricauda (Turp.) Bréb.	3	4	3	1	1				3	7	3	3	1					
S. quadricauda v. *longispina* (Chod.)																		
S. quadricauda v. *maximus* West & West										2								
S. quadricauda v. *westii* G.M. Smith																		
Scenedesmus sp.								3										
Scenedesmus sp. #1																		
Scenedesmus sp. #2																		
Scenedesmus sp. #3																		
Scenedesmus spp.																		
Schizochlamys compacta Prescott																		
S. gelatinosa A. Braun																		
Schroederia judayi G.M. Smith																		
S. setigera (Schroed.) Lemm.																		
Schroederia sp.																		
Selenastrum gracile Reinsch																		
Selenastrum sp.																		
Sorastrum americanum (Bohlin) Schmidle																		
S. spinulosum Näg.																		

(cont.)

Ta le 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Sphaerocystis schroeteri Chod.																		
Staurastrum spp.																		
Tetradesmus smithii Prescott																		
T. wisconsinense G.M. Smith																		
Tetraedron caudatum (Corda) Hansg.																		
T. lunula (Reinsch) Wille																		
T. minimum (A. Braun) Hansg.																		
T. muticum (A. Braun) Hansg.																		
T. regulare Kütz.																		
T. trigonum (Näg.) Hansg.																		
T. pentaedricum West & West																		
Tetraedron sp.															1			
Tetrastrum staurogeniaeforme (Schroed.) Lemm.																		
Tetrallantos lagerheimii Teiling?																		
Treubaria setigerum (Arch) G.M. Smith																		
Ulothrix sp.																		
Westella botryoides (W. West) Wildemann																		
W. linearis G.M. Smtih																		
Westella sp.																		
Undetermined green colony																		
Undetermined green cells																		
Colonial desmid																		
GREENS, percent composition in total phytoplankton	0.56	1.45	1.21	0.47	1.15	0.45	1.23	0.62	0.30	0.67	0.57	1.55	1.28	2.33	1.47	1.21	1.23	0.29

(cont.)

Table 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
TOTAL BLUE-GREENS	1	4		2	8	19	19	12		2	11	3	7	6	7	9	13	12
Anabaena circinalis Rabenh.																		
Anabaena spp.																		
Anacystis spp.																		
Aphanizomenon flos-aquae (L.) Ralfs																		
Aphanocapsa pulchra (Kütz.) Rabenh.																		
Aphanocapsa spp.					1	3							2					
Asterococcus limneticus G.M. Smith																		
Chroococcus limneticus Lemm.																		
Ch. minutus (Kütz.) Näg.																		
Ch. prescottii Drouet & Daily																		
Ch. turgidus (Kütz.) Näg.							9											
Chroococcus spp.																		
Coelosphaerium nägelianum Unger																		
Dactylococcopsis smithii Chod. & Chod.							4				2					1	4	
Gomphosphaeria aponina Kütz.																		
G. lacustris Chod.																		
Holopedium irregulare Lag.																		
Merismopedia elegans v. *major* G.M. Smith																		
M. tenuissima Lemm.																		
Microcystis aeruginosa Kütz.																		
Oscillatoria spp.	1	4		2	7	16	6	12		2	9	3	5	6	7	8	9	12
Phormidium spp.																		
BLUE-GREENS, percent composition in total phytoplankton	0.08	0.18		0.07	0.13	0.74	0.73	0.39		0.02	0.38	0.08	0.27	0.21	0.47	0.32	0.40	0.33

(cont.)

Table 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
TOTAL CHRYSOPHYTA	3	13		5	1	2	2	2		49	24	62	12	20	22	17	26	10
Centritractus belanophorus Lemm.																		
Dinobryon bavaricum Imhof																		
D. calciformis Bachmann																		
D. divergens Imhof	3	13		5	1	2	2	2		49	24	62	12	20	22	17	26	10
Vacuolomonas spp.																		
Ophiocytium capitatum v. *longispinum* (Moeb.) Lemm.																		
Ophiocytium sp.																		
Tribonema sp.																		
CHRYSOPHYTA, percent composition in total phytoplankton	0.20	0.54		0.17	0.02	0.08	0.09	0.06		0.51	0.79	1.79	0.47	0.65	1.42	0.62	0.77	0.28
TOTAL PYRROPHYTA	4	3		1	1	0.8						28	3	6	54	1	18	69
Ceratium hirundinella (O.F. Müll.) Dujardin																		
Cystodinium sp.																		
Glenodinium spp.																		
Peridinium spp.	4	3		1	1	0.8						28	3	6	54	1	18	69
Dinoflagellate cysts																		
PYRROPHYTA, percent composition in total phytoplankton	0.28	0.16		0.03	0.02	0.03						0.82	0.12	0.21	3.47	0.03	0.53	1.38
TOTAL FLAGELLATES	608	644	299	422	344	291	351	308	154	621	450	274	437	331	237	330	333	361
Chlamydomonas sp.	28	60	142	88	131	94	144	248	21	248	233	167	214	90	87	289	133	86
Cryptomonas sp.	47	44	26	11	46	10	25	53	62	76	64	42	56	32	42	43	39	
Euglena spp.									13	7	4	2					2	7
Lepocinclis spp.																		

(cont.)

Table 3 (cont.)

MONTH	March 1969								April 1969									
STATION	PP		MP		EP		LAKE		PP		MP			EP		LAKE		
DEPTH, METERS	1	6.6	1	7.5	1	14.2	1	19	1	6.6	1	6	14.5	1	15.7	1	14	25
Pteromonas sp.	1	1																
Phacus sp.		1																
Undetermined flagellates	532	538	131	323	167	147	182	207	58	290	149	63	167	209	108	218	159	263
FLAGELLATES, percent composition in total phytoplankton	39.61	26.56	9.64	13.66	5.58	9.61	13.22	15.51	3.61	6.36	14.68	7.81	15.90	10.53	15.20	19.39	10.16	9.84

(cont.)

Table 3 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
TOTAL GREENS	353	278	287	255	115	267	129	86	47	60	82
Actinastrum hantzschii Lag.	11	8	6	9		6	1				
Ankistrodesmus braunii (Näg.) Brunnthaler											
A. convolutus Corda				6		11	10				1
A. falcatus (Corda) Ralfs	52	49	99	96	60	73	56	47	33	48	63
A. falcatus v. *mirabilis* (West & West) G.S. West											
Ankistrodesmus spp.											
Characium sp.											
Chlorococcum sp.											
Chlorella vulgaris Beyerinck				4							
Closteriopsis longissima Lemm.				4		2	5				
Closterium sp.				6		1		2	1		1
Coelastrum cambricum Arch.											
C. microporum Näg.											
C. reticulatum (Dang.) Senn											
C. sphaericum Näg.											
Coelastrum sp.	6	8	51	2	6	11	4	5	1		
Cosmarium spp.		2			2		2				
Crucigenia apiculata (Lemm.) Schmidle											
C. irregularis Wille											
C. lauterbornii Schmidle											
C. quadrata Morren	8	6									
C. rectangularis (A.Braun) Gay						7					
C. tetrapedia (Kirch.) West & West					2	2					
C. truncata G.M. Smith											

(cont.)

Table 3 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
Desmatractum sp.											
Dictyosphaerium ehrenbergianum Näg.											
D. pulchellum Wood	78	80	48	27	2	16	6	3	1	2	1
Dimorphococcus lunatus A. Braun											
Dactylococcus infusionum Näg.											
Elakatothrix gelatinosa Wille											
E. viridis (Snow) Printz				2							
Elakatothrix spp.											
Euastropsis sp.											
Excentrosphaera viridis Moore											
Franceia droescheri (Lemm.) G.M. Smith											
F. ovalis (Francé) Lemm.											
Gloeocystis ampla (Kütz.) Lag.											
G. gigas (Kütz.) Lag.											
G. major Gerneck ex Lemm.				2		2					
G. planktonica (West & West) Lemm.											
G. vesiculosa Näg.											
Gloeocystis sp.				4			2		1		
Gloeocystis spp.											
Golenkinia radiata (Chod.) Wille				2	2						
Kirchneriella contorta (Schmidle) Bohlin											
K. elongata G.M. Smith								1			1
K. lunaris (Kirch.) Moeb.											
K. obesa (W. West) Schmidle											
K. subsolitaria G.S. West											
Kirchneriella sp.				3		6					

(cont.)

Table 3 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
Lagerheimia ciliata (Lag.) Chod.											
L. citriformis (Snow) G.M. Smith											
L. longiseta (Lemm.) Printz											
L. quadriseta (Lemm.) G.M. Smith	8	5	6	4		4					
Lagerheimia sp.											
Mougeotia sp.											
Nephrocytium agardhianum Näg.											
N. limneticum (G.M. Smith) G.M. Smith											
N. obesum West & West											
Nephrocytium sp.				1			2				
Oedogonium sp.											
Oocystis borgei Snow	2	1		1	1	2	1	2	1	2	2
O. crassa Wittrock											
O. elliptica W. West											
O. eremosphaeria G.M.Smith											
O. gigas Arch.											
O. gloeocystiformis Borge											
O. lacustris Chod.											
O. nodulosa West & West											
O. panduriformis West & West											
O. parva West & West											
O. pusilla Hansg.											
O. pyriformis Prescott											
O. solitaria Wittrock	44	16	17	9		20	5	3	1		
O. submarina Lag.											
Oocystis sp.				1	1						
Oocystis spp.	13	5	2				2	2			

(cont.)

Table 3 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
Pediastrum biradiatum Meyen											
P. boryanum (Turp.) Menegh.											
P. duplex Meyen											
P. integrum Näg.											
P. obtusum Lucks											
P. simplex (Meyen) Lemm.			2								
P. simplex v. *duodenarium* (Bailey) Rabenh.											
P. tetras (Ehr.) Ralfs											
Pediastrum spp.											
Phaeococcus planctonicus West & West											
Planktosphaeria gelatinosa G.M. Smith											
Quadrigula chodatii (Tan.-Ful.) G.M. Smith											
Q. closteroides (Bohlin) Printz											
Q. lacustris (Chod.) G.M. Smith				1	8	6	8	2	3	3	5
Quadrigula spp.											
Scenedesmus abundans (Kirch.) Chod.	61	48	24	9	4	11	14	7	1	5	4
S. abundans v. *brevicauda* G.M. Smith											
S. acuminatus (Lag.) Chod.						2					
S. acutiformis Schroed.						2					
S. arcuatus Lemm.											
S. arcuatus v. *platydisca* G.M. Smith											
S. armatus (Chod.) G.M. Smith											
S. armatus v. *major* G.M. Smith											
S. bernardii G.M. Smith											
S. bijuga (Turp.) Lag.						2			1		

(cont.)

Table 3 (cont.)

MONTH	May 1969										
STATION	FP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
S. bijuga v. *alternans* (Reinsch) Hansg.			2								
S. denticulatus Lag.											
S. dimorphus (Turp.) Kütz.	6	5		7	2	2					0.6
S. incrassatulus Bohlin	17	18	7	4	2	7					0.6
S. incrassatulus v. *mononae* G.M. Smith											
S. longus v. *nägelii* (Bréb.)											
S. obliquus (Turp.) Kütz.											
S. opoliensis P. Richter	13		4	8		13	3				0.6
S. opoliensis v. *contacta* Prescott				3		2					
S. perforatus Lemm.				7							
S. protuberans Fritsch						6					
S. quadricauda (Turp.) Bréb.	30	27	19	2	13	17	2	4	2		2
S. quadricauda v. *longispina* (Chod.)				2							
S. quadricauda v. *maximus* West & West				6	4	4		4			
S. quadricauda v. *wattii* G.M. Smith				2							
Scenedesmus sp.											
Scenedesmus sp. #1											
Scenedesmus sp. #2											
Scenedesmus sp. #3											
Scenedesmus spp.											
Schizochlamys compacta Prescott											
S. gelatinosa A. Braun											
Schroederia judayi G.M. Smith						2					
S. setigera (Schroed.) Lemm.											
Schroederia sp.											
Selenastrum gracile Reinsch											
Selenastrum sp.											
Sorastrum americanum (Bohlin) Schmidle											
S. spinulosum Näg.											

(cont.)

Table 3 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
Sphaerocystis schroeteri Chod.											
Staurastrum spp.											
Tetradesmus smithii Prescott											
T. wisconsinense G.M. Smith											
Tetraedron caudatum (Corda) Hansg.							2				
T. lunula (Reinsch) Wille			2	2							
T. minimum (A. Braun) Hansg.	4		2				2		1		
T. muticum (A. Braun) Hansg.											
T. regulare Kütz.											
T. trigonum (Näg.) Hansg.				2				4			
T. pentaedricum West & West											
Tetraëdron sp.											
Tetrastrum staurogeniaeforme (Schroed.) Lemm.					2	2					
Tetrallantos lagerheimii Teiling?											
Treubaria setigerum (Arch.) G.M. Smith											
Ulothrix sp.				2	2		3				
Westella botryoides (W. West) Wildemann						26					
W. linearis G.M. Smith											
Westella sp.											
Undetermined green colony				13							
Undetermined green cells											
Colonial desmid											
GREENS, percent composition in total phytoplankton	6.99	4.26	4.36	8.93	4.32	9.14	5.18	3.60	3.08	3.37	4.40

(cont.)

Table 3 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
TOTAL BLUE-GREENS	10	13	20	35	27	9	22	11	10	22	9
Anabaena circinalis Rabenh.											
Anabaena spp.											
Anacystis spp.											
Aphanizomenon flos-aquae (L.) Ralfs				20	6	2					
Aphanocapsa pulchra (Kütz.) Rabenh.											
Aphanocapsa spp.										2	
Asterococcus limneticus G.M. Smith											
Chroococcus limneticus Lemm.											
Ch. minutus (Kütz.) Näg.							2				
Ch. prescottii Drouet & Daily											
Ch. turgidus (Kütz.) Näg.											
Chroococcus spp.											
Coelosphaerium nägelianum Unger											
Dactylococcopsis smithii Chod. & Chod.											
Gomphosphaeria aponina Kütz.											
G. lacustris Chod.				4							
Holopedium irregulare Lag.											
Merismopedia elegans v. *major* G.M. Smith											
M. tenuissima Lemm.											
Microcystis aeruginosa Kütz.											
Oscillatoria spp.	10	13	20	11	19	7	20	11	10	20	9
Phormidium spp.					2						
BLUE-GREENS, percent composition in total phytoplankton	0.21	0.20	0.31	1.23	1.04	0.31	0.89	0.46	0.66	1.24	0.50

(cont.)

Table 3 (cont.)

MONTH STATION DEPTH, METERS	FP 1	 6.6	 1	MP 5	 13	May 1969 1	EP 5	 16	 1	LAKE 10	 25
TOTAL CHRYSOPHYTA	117	51	28	90	37	141	34		22	6	22
Centritractus belanophorus Lemm.											
Dinobryon bavaricum Imhof *D. calciformis* Bachmann *D. divergens* Imhof	117	81	28	56	2	95	8		5	6	2
Mallomonas spp.				34	31	46	23		17		20
Ophiocytium capitatum v. *longispinum* (Moeb.) Lemm. *Ophiocytium* sp.											
Tribonema sp.					4		3				
CHRYSOPHYTA, percent composition in total phytoplankton	2.33	1.25	0.42	3.17	1.39	4.83	1.39		1.46	0.35	1.19
TOTAL PYRROPHYTA	6	13	4	37	30	20	25	13	13	14	28
Ceratium hirundinella (O.F. Müll.) Dujardin											
Cystodinium sp.											
Glenodinium spp.											
Peridinium spp.	6	13	4	37	30	20	25	13	13	14	28
Dinoflagellate cysts											
PYRROPHYTA, percent composition in total phytoplankton	0.12	0.20	0.06	1.30	1.11	0.70	1.02	0.54	0.88	0.80	1.54
TOTAL FLAGELLATES	497	480	637	645	720	469	914	497	379	334	608
Chlamydomonas sp.	6	32	208	240	403	250	723	378	187	200	383
Cryptomonas sp.	339	315	178	218	100	161	149	78	61	26	111
Euglena spp.								4			
Lepocinclis spp.											

(cont.)

Table 3 (cont.)

MONTH	May 1969										
STATION	PP		MP			EP			LAKE		
DEPTH, METERS	1	6.6	1	5	13	1	5	16	1	10	25
Pteromonas sp.	6		4						8		
Phacus sp.						2					
Undetermined flagellates	146	133	247	187	217	56	42	37	123	108	114
FLAGELLATES, percent composition in total phytoplankton	9.83	7.36	9.67	22.57	26.99	16.06	36.65	20.61	24.51	18.49	32.53

(cont.)

Table 3 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
TOTAL GREENS	2035	1345	424	171	73	357	54	60	59	1045	1524	504	282	475	182	583	161	38	147	72	32
Actinastrum hantzschii Lag.	338	188	36	3		7				5	37	4	4	4		4			1		
Ankistrodesmus braunii (Näg.) Brunnthaler	122	93	12	9		46				4	7	3	3	9							
A. convolutus Corda	30	9	6	1		5	4	2						2							
A. falcatus (Corda) Ralfs	192	237	45	28	9	55	8	11	13	69	52	47	21	60	6	68	5	2	4		
A. falcatus v. *mirabilis* (West & West) G.S. West																					
Ankistrodesmus spp.																					
Characium sp.																					
Chlorococcum sp.																					
Chlorella vulgaris Beyerinck																					
Closteriopsis longissima Lemm.	96	42	7	4	1	10				23	104	18	2	11	3	13	1				
Closterium sp.	15	21	8	9		4	3	7	3		15	2	2	4	4	5	2	1	1	3	
Coelastrum cambricum Arch.																					
C. microporum Näg.																					
C. reticulatum (Dang.) Senn								1	1				2			3	1	1		1	
C. sphaericum Näg.	22	21	2		3	7				15	96	6	10	7	2	4		1	1		6
Coelastrum sp.						4															
Cosmarium spp.				1				1				6	1	4		5	1		1	2	
Crucigenia apiculata (Lemm.) Schmidle	30	14	1								22	94	4	7		3	4			0.4	
C. irregularis Wille																					
C. lauterbornii Schmidle																					
C. quadrata Morren		7	4					1		15	15	13	8	13	4			1	2		
C. rectangularis (A.Braun) Gay																					
C. tetrapedia (Kirch.) West & West			4									14	4			21					
C. truncata G.M. Smith																					

(cont.)

Table 3 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
Desmatractum sp.	25	21	2	1							22										
Dictyosphaerium ehrenbergianum Näg.	7	4					2					4	1		2	2					
D. pulchellum Wood	89	86	19	5	3	19	2	4		45	104	13	18	20	6	30	4	2	1	1	
Dimorphococcus lunatus A. Braun										30	30										
Dactylococcus infusionum Näg.																					
Elakatothrix gelatinosa Wille											5		1		2	3	2				
E. viridis (Snow) Printz																					
Elakatothrix spp.											2										
Euastropsis sp.																					
Excentrosphaera viridis Moore																					
Franceia droescheri (Lemm.) G.M. Smith								1					1	1							
F. ovalis (Francé) Lemm.																					
Gloeocystis ampla (Kütz.) Lag.																					
G. gigas (Kütz.) Lag.																					
G. major Gerneck ex Lemm.							2		1			4								1	
G. planktonica (West & West) Lemm.											15										
G. vesiculosa Näg.																					
Gloeocystis sp.																					
Gloeocystis spp.	267	160	67	13	7	46		1	2	74	148	54	55	48	18	83	22	1	9	11	9
Golenkinia radiata (Chod.) Wille										7				4			1				
Kirchneriella contorta (Schmidle) Bohlin																					
K. elongata G.M. Smith	5	7	6				2		1	22	7	4	3	2			1			1	
K. lunaris (Kirch.) Moeb.										15	8										
K. obesa (W. West) Schmidle		7				4				37	30	2		3		4					
K. subsolitaria G.S. West																					
Kirchneriella sp.	8																				

(cont.)

Table 3 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
Lagerheimia ciliata (Lag.) Chod.																					
L. citriformis (Snow) G.M. Smith																					
L. longiseta (Lemm.) Printz												2									
L. quadriseta (Lemm.) G.M. Smith	5	9				2		1	1	22			1			4	2				
Lagerheimia sp.																					
Mougeotia sp.												11	9	30	26	14	15	5			
Nephrocytium agardhianum Näg.										7	30	18	6	14	4	6	3				
N. limneticum (G.M. Smith) G.M. Smith														2							
N. obesum West & West														2							
Nephrocytium sp.				4	1	2								2					1		
Oedogonium sp.												4			7	4	4	3	1	1	
Oocystis borgei Snow	8	6	1	1		3	1	1			5			3	5	2	1		2	3	
O. crassa Wittrock																					
O. elliptica W. West																					
O. eremosphaeria G.M. Smith																				5	
O. gigas Arch.																					
O. gloeocystiformis Borge															1	1			2	4	
O. lacustris Chod.											12	7	2	8	6	3	1		1		
O. nodulosa West & West																					
O. panduriformis West & West															1						
O. parva West & West											8	3	2	3	2		1				
O. pusilla Hansg.												6	4	6	3	12	4		9	5	
O. pyriformis Prescott																					
O. solitaria Wittrock	156	146	67	22	9	20	5	4	2	59	82	18	23	22	21	45	13	3	57	12	1
O. submarina Lag.																				5	
Oocystis sp.																					2
Oocystis spp.	14	8	6	5	3	9	2	2	4	29	32	20	9	34	16	58	26	8	34	10	

(cont.)

Table 3 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
Pediastrum biradiatum Meyen																					
P. boryanum (Turp.) Menegh.																					
P. duplex Meyen	37		2					1	2	30	45			6	2						
P. integrum Näg.																					
P. obtusum Lucks																					
P. simplex (Meyen) Lemm.										7	3										
P. simplex v. *duodenarium* (Bailey) Rabenh.								1					0.6	2							
P. tetras (Ehr.) Ralfs																					
Pediastrum spp.			4			7				15	19	12	12	7		11	7		2	0.4	2
Phaeococcus planctonicus West & West																					
Planktosphaeria gelatinosa G.M. Smith																					
Quadrigula chodatii (Tan.-Ful.) G.M. Smith																					
Q. closteroides (Bohlin) Printz											7										
Q. lacustris (Chod.) G.M. Smith	8	7	6			2	2	2		7	7	6	5	11	4	17	3	2	10	3	
Quadrigula spp.																					
Scenedesmus abundans (Kirch.) Chod.	97	14	41	11	14	19	4	3	14	156	260	44	15	44	3	33	15	2	2	1	3
S. abundans v. *brevicauda* G.M. Smith																					
S. acuminatus (Lag.) Chod.										6	15										
S. acutiformis Schroed.																					
S. arcuatus Lemm.																					
S. arcuatus v. *platydisca* G.M. Smith																					
S. armatus (Chod.) G.M. Smith	15			7							7										
S. armatus v. *major* G.M. Smith																					
S. bernardii G.M. Smith																					
S. bijuga (Turp.) Lag.	15	7	9	2		4	2		2				3			4	2	1			

(cont.)

Table 3 (cont.)

MONTH	June 1969									July 1969												
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE			
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
S. bijuga v. *alternans* (Reinsch) Hansg.																					
S. denticulatus Lag.	7					2					22		1					2		1	-
S. dimorphus (Turp.) Kütz.	74	70	9	15	5	23	2	5	2	15	22	6	4	9	7	6		1	1		1
S. incrassatulus Bohlin	207	84	15	7		21	1	2	2	22	52	2	2	2		8			1		
S. incrassatulus v. *mononae* G.M. Smith																					
S. longus v. *nägelii* (Bréb.)																					
S. obliquus (Turp.) Kütz.																					
S. opoliensis P. Richter	45	28	6	9	5	9	2		0.6	45	74	22	18	13	3	45	6	1	1		
S. opoliensis v. *contacta* Prescott																					
S. perforatus Lemm.	7	5	6	4		5			2			4									
S. protuberans Fritsch																					
S. quadricauda (Turp.) Bréb.	23	5	22	2	5	4	7	2	4	31	30	8	6	11	2	22	2			1	1
S. quadricauda v. *longispina* (Chod.)																					
S. quadricauda v. *maximus* West & West					5			1													
S. quadricauda v. *westii* G.M. Smith										7											
Scenedesmus sp.																					
Scenedesmus sp. #1																					
Scenedesmus sp. #2																					
Scenedesmus sp. #3																					
Scenedesmus spp.																					
Schizochlamys compacta Prescott											7		4								
S. gelatinosa A. Braun																					
Schroederia judayi G.M. Smith			2							5				1		2					
S. setigera (Schroed.) Lemm.														3							
Schroederia sp.																					
Selenastrum gracile Reinsch											7										
Selenastrum sp.																					
Sorastrum americanum (Bohlin) Schmidle											7				1						
S. spinulosum Näg.						2					5				3						

(cont.)

Table 3 (cont.)

MONTH	June 1969								
STATION	PP		MP			EP		LAKE	
DEPTH, METERS	1	8	1	5	11	1	16	1	20
Sphaerocystis schroeteri Chod.									
Staurastrum spp.	8	9	1			2			
Tetradesmus smithii Prescott									
T. wisconsinense G.M. Smith									
Tetraëdron caudatum (Corda) Hansg.	5			2				1	
T. lunula (Reinsch) Wille	37	28		2	2	9	3		
T. minimum (A. Braun) Hansg.	7			2		2			
T. muticum (A. Braun) Hansg.									
T. regulare Kütz.									
T. trigonum (Näg.) Hansg.	7		4						1
T. pentaedricum West & West									
Tetraëdron sp.									
Tetrastrum staurogeniaeforme (Schroed.) Lemm.	7		3	2		2			
Tetrallantos lagerheimii Teiling?									
Treubaria setigerum (Arch.) G.M. Smith			2						
Ulothrix sp.					3			7	2
Westella botryoides (W. West) Wildemann									
W. linearis G.M. Smith									
Westella sp.									
Undetermined green colony						2			
Undetermined green cells									
Colonial desmid									
GREENS, percent composition in total phytoplankton	16.13	12.53	7.48	4.23	1.93	7.30	1.48	2.40	2.76

MONTH	July 1969											
STATION	PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	14	1	15	1	8	15	1	14	31
Sphaerocystis schroeteri Chod.												
Staurastrum spp.	7		2	1	2		4	1				1
Tetradesmus smithii Prescott		15										
T. wisconsinense G.M. Smith					1		2	1				
Tetraëdron caudatum (Corda) Hansg.	22	7						2				
T. lunula (Reinsch) Wille	23	5	6	5		6	9	2	1	1		
T. minimum (A. Braun) Hansg.	22			1	22	4	4			1		1
T. muticum (A. Braun) Hansg.							2					
T. regulare Kütz.		5										
T. trigonum (Näg.) Hansg.	7		3	3			6	2				
T. pentaedricum West & West												
Tetraëdron sp.												
Tetrastrum staurogeniaeforme (Schroed.) Lemm.	15		12	5	9	2	11	2		1		
Tetrallantos lagerheimii Teiling?												
Treubaria setigerum (Arch.) G.M. Smith	22						2					
Ulothrix sp.							2					
Westella botryoides (W. West) Wildemann												
W. linearis G.M. Smith	96	15				6						
Westella sp.	7											
Undetermined green colony				1	6							2
Undetermined green cells												
Colonial desmid												
GREENS, percent composition in total phytoplankton	10.46	8.05	12.27	6.52	9.67	8.54	9.90	5.57	2.38	17.93	5.38	1.80

(cont.)

Table 3 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
TOTAL BLUE-GREENS	51	32	53	38	76	50	56	111	96		37	11	9	26	25	29	8	3	15	5	25
Anabaena circinalis Rabenh.																			1		
Anabaena spp.		5						1				1	1	7	6	8	4		5	1	
Anacystis spp.			2																4		
Aphanizomenon flos-aquae (L.) Ralfs								3				1	1								2
Aphanocapsa pulchra (Kütz.) Rabenh.																					
Aphanocapsa spp.																					
Asterococcus limneticus G.M. Smith																					
Chroococcus limneticus Lemm.								0.4					1							1	
Ch. minutus (Kütz.) Näg.																					
Ch. prescottii Drouet & Daily																					
Ch. turgidus (Kütz.) Näg.																					
Chroococcus spp.											7			1	3						
Coelosphaerium nägelianum Unger																			1		1
Dactylococcopsis smithii Chod. & Chod.																			2		
Gomphosphaeria aponina Kütz.									27												
G. lacustris Chod.									0.6												
Holopedium irregulare Lag.																					
Merismopedia elegans v. major G.M. Smith									1			1		1							
M. tenuissima Lemm.																2					
Microcystis aeruginosa Kütz.					4				1							2	1				
Oscillatoria spp.	51	14	51	38	72	50	56	107	66		8	8	6	8	5	2		1	1	3	22
Phormidium spp.		13									22			9	11	15	3	2			
BLUE-GREENS, percent composition in total phytoplankton	0.41	0.30	0.95	0.96	2.02	1.02	1.53	4.40	4.48		0.20	0.28	0.21	0.53	1.21	0.50	0.30	0.24	1.90	0.42	1.42

(cont.)

Table 3 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
TOTAL CHRYSOPHYTA	66	200	85	37	52	61	52	36	28	22	97	202	192	269	371	345	222	35	197	273	16
Centritractus belanophorus Lemm.																					
Dinobryon bavaricum Imhof													1	2	6		1				
D. calciformis Bachmann				6	2	5	2	5					2	5	6	16	3				
D. divergens Imhof		21	20	18	12	7	9	18	8	7		196	177	253	357	311	211	32	186	272	
Mallomonas spp.	66	146	63	13	37	44	41	13	17	15	89	6	8	9	2	14	6	3	3		9
Ophiocytium capitatum v. *longispinum* (Moeb.) Lemm.		33	2		1	5					8		2			4					
Ophiocytium sp.																					
Tribonema sp.									3				2				1		8	1	7
CHRYSOPHYTA, percent composition in total phytoplankton	0.53	1.87	1.50	0.92	1.38	1.25	1.42	1.43	1.33	0.22	0.51	4.92	4.50	5.47	17.40	5.86	7.65	2.17	23.92	20.19	0.91
TOTAL PYRROPHYTA		4	2	8	2	6	11	9	6	97	74	52	21	48	4	65	3	5	3	2	13
Ceratium hirundinella (O.F. Müll.) Dujardin													1	2							
Cystodinium sp.																					
Glenodinium spp.													3								
Peridinium spp.		4	2	8	2	6	11	9	1	97	59	32	17	46	4	61	3	5	3	1	11
Dinoflagellate cysts									5		15					2				1	2
PYRROPHYTA, percent composition in total phytoplankton		0.04	0.03	0.21	0.06	0.13	0.31	0.38	0.30	0.97	0.39	0.77	0.49	0.98	0.17	1.07	0.09	0.28	0.37	0.19	0.77
TOTAL FLAGELLATES	1191	814	508	29	299	472	271	333	105	335	265	281	44	313	45	134	72	3	6	6	56
Chlamydomonas sp.	341	139	200	17	170	242	164	236	67	67	44	198	15	210	28	104	37	3	3	3	26
Cryptomonas sp.	794	612	291	8	129	214	107	97	37	223	177	79	26	103	17	30	35		2	3	30
Euglena spp.	21	35	4	2		10				30	37	2									
Lepocinclis spp.		7										2	2						1		

(cont.)

Table 3 (cont.)

MONTH	June 1969									July 1969											
STATION	PP		MP			EP		LAKE		PP		MP(4)		MP(1)		EP			LAKE		
DEPTH, METERS	1	8	1	5	11	1	16	1	20	1	8	1	14	1	15	1	8	15	1	14	31
Pteromonas sp.	35		4	2		5			1	15	7		1								
Phacus sp.		21	9			1															
Undetermined flagellates																					
FLAGELLATES, percent composition in total phytoplankton	9.44	7.58	8.97	0.74	7.92	9.63	7.33	13.24	4.92	3.35	1.40	6.84	1.04	6.37	2.10	2.28	2.49	0.17	0.69	0.47	3.09

(cont.)

MONTH	August 1969																
STATION		PP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	.8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
TOTAL GREENS	660	2099	2356	2976	1688	4057	369	370	565	639	409	301	365	543	381	338	51
Actinastrum hantzschii Lag.	4	17	30	9	5	6											
Ankistrodesmus braunii (Näg.) Brunnthaler	2				4	5	2		4	4		1					
A. convolutus Corda					26												
A. falcatus (Corda) Ralfs	114	172	192	371	206	226	17	13	25	1	1	7	26		3	6	1
A. falcatus v. *mirabilis* (West & West) G.S. West																	
Ankistrodesmus spp.																	
Characium sp.	2							3		9		3	4	4	27		1
Chlorococcum sp.							13										
Chlorella vulgaris Beyerinck								1		161	66	39	22	37	52	33	
Closteriopsis longissima Lemm.	7	41	45	84	26	45	1	2	18	4	1	1	2				1
Closterium sp.		4	7		4	19		2					1				1
Coelastrum cambricum Arch.							1										
C. microporum Näg.																	
C. reticulatum (Dang.) Senn		4	14	9	30	9	12	16	15	10	12	13	9	98	8	15	
C. sphaericum Näg.	3	29	24	9	22	9		0.6		1	2	2					
Coelastrum sp.																	
Cosmarium spp.	5	11	7			9			4							1	
Crucigenia apiculata (Lemm.) Schmidle	14	171	140	158	45	71	3	10	11	6	1	3					
C. irregularis Wille																	
C. lauterbornii Schmidle																	
C. quadrata Morren					4	31	1	7		4	15	10	26	15	13	9	
C. rectangularis (A.Braun)Gay			30	56	4	25	4	2				5	2	6	5	12	
C. tetrapedia (Kirch.) West & West																	
C. truncata G.M. Smith			28			3											

(cont.)

Table 3 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
Desmatractum sp.		3			4	9			4			1					1
Dictyosphaerium ehrenbergianum Näg.		6	6										1				
D. pulchellum Wood	4	52	66	84	26	93	3	3	4			1	4			2	
Dimorphococcus lunatus A. Braun		4					1										
Dactylococcus infusionum Näg.																	
Elakatothrix gelatinosa Wille				8	17	4				2		1					1
E. viridis (Snow) Printz				1	2												
Elakatothrix spp.	4																
Euastropsis sp.								1									
Excentrosphaera viridis Moore					30	2											
Franceia droescheri (Lemm.) G.M. Smith				9	3		1							2			
F. ovalis (Francé) Lemm.														1			
Gloeocystis ampla (Kütz.) Lag.				9													
G. gigas (Kütz.) Lag.							4	1		13	14		1			1	
G. major Gerneck ex Lemm.				46	30		9	4	7	1						1	
G. planktonica (West & West) Lemm.	3	41	73	121	48	99	31	40	67	98	53	18	14	89	34	30	9
G. vesiculosa Näg.												3		1	4		
Gloeocystis sp.																	
Gloeocystis spp.																	
Golenkinia radiata (Chod.) Wille	133	377	326	519	293	204	26	21	19	6	3	9	11	1		4	1
Kirchneriella contorta (Schmidle) Bohlin																	
K. elongata G.M. Smith	3	19	1		3					1			2			3	
K. lunaris (Kirch.) Moeb.	2	11	4				2	2			1	3	1				
K. obesa (W. West) Schmidle	4	11		25	3	19	1	2	4	2			2				
K. subsolitaria G.S. West																	
Kirchneriella sp.																	

(cont.)

Table 3 (cont.)

MONTH	August 1969																
STATION		PP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
Lagerheimia ciliata (Lag.) Chod.		3	2		2	3	1	1		6	4	7	8	14	13	12	
L. citriformis (Snow) G.M. Smith		1	2		5	6	5	6	6	2	1			1	4	3	
L. longiseta (Lemm.) Printz		3	5			1	3	2		6		2	2	2			
L. quadriseta (Lemm.) G.M. Smith		4	1	9		1	1										
Lagerheimia sp.													2				
Mougeotia sp.			21	9	11	9	10	3	3	2	3	5	24			9	1
Nephrocytium agardhianum Näg.	7	4	30	46	22	10	1	7	7	3	1	2					
N. limneticum (G.M. Smith) G.M. Smith																	
N. obesum West & West								3									
Nephrocytium sp.																	
Oedogonium sp.													1				
Oocystis borgei Snow	4	7	3	46	15	37	3	2		3	12	3	1	7	3	5	1
O. crassa Wittrock	6	22	11	9	7	16	2	1	17	20	18	9	10	11	14	17	2
O. elliptica West							1	4		3	3		2	4	3		
O. eremosphaeria G.M. Smith								1									
O. gigas Arch.																	
O. gloeocystiformis Borge											49	25	36	31	29	22	8
O. lacustris Chod.		15	23	28		19	38	57	77	19	26	22	10	28	34	29	2
O. nodulosa West & West								4	4								
O. panduriformis West & West															1		
O. parva West & West	7	45	22	9	26	84	30	14	37	123	40	48	54	60	36	33	7
O. pusilla Hansg.				9	4	19		5	15	4	9		2		1	1	1
O. pyriformis Prescott																	
O. solitaria Wittrock	108	134	148	149	86	114	32	32	91	15	21	8	24	39	30	37	8
O. submarina Lag.				37	7	37	33	28	21	47	11	13	10	13	5	4	
Oocystis sp.																17	
Oocystis spp.																	

(cont.)

Table 3 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
Pediastrum biradiatum Meyen																	
P. longinum (Turp.) Menegh.																	
P. duplex Meyen	9	30	28	14	8	84	2						2				1
P. integrum Näg.																	
P. obtusum Lucks																	
P. simplex (Meyen) Lemm.	5	19	9	6	1	29		1					2				
P. simplex v. *duodenarium* (Bailey) Rabenh.	2	7	13	1	6	37											
P. tetras (Ehr.) Ralfs																	
Pediastrum spp.	2	55	16	7		27	2	1					1				
Phacococcus planctonicus West & West							1										
Planktosphaeria gelatinosa G.M. Smith							2		4		9	1	7	9	2	2	1
Quadrigula chodatii (Tan.-Ful.) G.M. Smith				7										4			
Q. closterioides (Bohlin) Printz							1										
Q. lacustris (Chod.) G.M. Smith		8	14	19	19		4	2	3	2	3	2	2	8	3	4	
Quadrigula spp.																	
Scenedesmus abundans (Kirch.) Chod.	78	226	451	390	260	548	17	14	11	2		1	7			1	
S. abundans v. *brevicauda* G.M. Smith																	
S. acuminatus (Lag.) Chod.				19	7		1										
S. acutiformis Schroed.			8														
S. arcuatus Lemm.		4	7														
S. arcuatus v. *platydisca* G.M. Smith	3		10				3										
S. armatus (Chod.) G.M.Smith		7			11												
S. armatus v. *major* G.M. Smith																	
S. bernardii G.M. Smith		8	18		7	19											
S. bijuga (Turp.) Lag.		3			13		2	3	4				1			1	

(cont.)

Table 3 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
S. bijuga v. *alternans* (Reinsch) Hansg.					2												
S. denticulatus Lag.		7	7		3	25		3					1				
S. dimorphus (Turp.) Kütz.	3	25	45		4			0.6				1					
S. incrassatulus Bohlin	11	21	23	56	15	56	1										
S. incrassatulus v. *mononae* G.M. Smith						12											
S. longus v. *nägelii* (Bréb.)																	
S. obliquus (Turp.) Kütz.																	
S. opoliensis P. Richter	45	256	177	263	141	334	8	13	7	3		2	3			4	
S. opoliensis v. *contacta* Prescott																	
S. perforatus Lemm.	4	11	15				2		4								
S. protuberans Fritsch																	
S. quadricauda (Turp.) Bréb.	26	84	96	56	55	84	9	4	11			3	3			2	
S. quadricauda v. *longispina* (Chod.)																	
S. quadricauda v. *maximus* West & West	4																
S. quadricauda v. *westii* G.M. Smith																	
Scenedesmus sp.		37		43		64											
Scenedesmus sp. #1																	
Scenedesmus sp. #2																	
Scenedesmus sp. #3																	
Scenedesmus spp.																	
Schizochlamys compacta Prescott								5	7								
S. gelatinosa A. Braun				19			2	3		10	7		3	1			1
Schroederia judayi G.M. Smith	4												1				
S. setigera (Schroed.) Lemm.							1										
Schroederia sp.				7													
Selenastrum gracile Reinsch																	
Selenastrum sp.																	
Sorastrum americanum (Bohlin) Schmidle				1													
S. spinulosum Näg.		4	13	2				2									

(cont.)

Table 3 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
Sphaerocystis schroeteri Chod.						9				13		7	5	8	5	1	1
Staurastrum spp.		5			3		1						1				
Tetradesmus smithii Prescott	4	19	7	19	18		2	1			1	1					
T. wisconsinense G.M. Smith							1										
Tetraëdron caudatum (Corda) Hansg.	4		15				3										
T. lunula (Reinsch) Wille	3	4	22	9	11	19	1	1									
T. minimum (A. Braun) Hansg.	4	4	14	19	4	18							2	3		2	
T. muticum (A. Braun) Hansg.								1	4	3		5	3	3	5	1	
T. regulare Kütz.				12	11												
T. trigonum (Näg.) Hansg.		7	10	6		40	1						1				
T. pentaedricum West & West		15		12	4	19											
Tetraëdron sp.																	
Tetrastrum staurogeniaeforme (Schroed.) Lemm.		7	22	56	11	65	1	5	11	3	1						
Tetrallantos lagerheimii Teiling?			10	9													
Treubaria setigerum (Arch.) G.M. Smith	7	11	8	9	3	9	1						1				
Ulothrix sp.			7					1	4								
Westella botryoides (W.West) Wildemann	3	2	19	6	4	6	3	7	16	23	14	11	5	37	43	15	1
W. linearis G.M. Smith	1	2	11	3	22	13	3	2	14	2	5	3	2	7	2		
Westella sp.							2										
Undetermined green colony				37	8												
Undetermined green cells									5								
Colonial desmid						1298											
GREENS, percent composition in total phytoplankton	30.87	18.54	22.39	42.72	35.93	28.11	39.12	35.37	46.19	76.66	79.56	71.51	20.24	82.87	84.17	32.73	11.06

(cont.)

Table 3 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
TOTAL BLUE-GREENS			12	39	31	52	51	60	48	93	85	77	31	94	63	41	7
Anabaena circinalis Rabenh.																	
Anabaena spp.				8	3	6	4	4	11	4	1	3	1	10	2		1
Anacystis spp.								13	7	12	7	3	2	3	3	4	1
Aphanizomenon flos-aquae (L.) Ralfs						6	1	3				2	2			1	
Aphanocapsa pulchra (Kütz.) Rabenh.																	
Aphanocapsa spp.							15	12		10		2	1		1	2	
Asterococcus limneticus G.M. Smith																	
Chroococcus limneticus Lemm.			5	6	4	6	7	6	1	13	15	13	6	7	5	11	
Ch. minutus (Kütz.) Näg.				9	2	1		1	7								
Ch. prescottii Drouet & Daily				10	9	5	17	16	15	51	53	45	13	69	49	23	2
Ch. turgidus (Kütz.) Näg.																	
Chroococcus spp.																	
Coelosphaerium nagelianum Unger																	
Dactylococcopsis smithii Chod. & Chod.																	
Gomphosphaeria aponina Kütz.																	
G. lacustris Chod.																	
Holopedium irregulare Lag.																	
Merismopedia elegans v. *major* G.M. Smith																	
M. tenuissima Lemm.																	
Microcystis aeruginosa Kütz.								5		3	9	7	4	5	6		
Oscillatoria spp.				6	13	9	5	0.6	7			1	2				3
Phormidium spp.			7			19	1					1					
BLUE-GREENS, percent composition in total phytoplankton			0.12	0.57	0.67	0.36	5.40	5.82	3.92	11.18	16.69	18.28	1.73	14.40	15.03	4.00	1.59

(cont.)

Table 3 (cont.)

MONTH	August 1969																
STATION	PP			MP			EP			LAKE(1)				LAKE(2)			
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
TOTAL CHRYSOPHYTA	7	15	73	28	37	32	6	6	7	6	2	5	16	5	2	12	2
Centritractus belonophorus Lemm.																	
Dinobryon bavaricum Imhof																	
D. sociforms Backmann																	
D. divergens Imhof	3			9		13	5	6	7	4		5	13	3	2	10	1
Mallomonas spp.		7	52		29	19	1			2	2		3	2		2	1
Ophiocytium capitatum v. *longispinum* (Moeb.) Lemm.																	
Ophiocytium sp.	4	8	21	19	8												
Tribonema sp.																	
CHRYSOPHYTA, percent composition in total phytoplankton	0.34	0.14	0.70	0.40	0.79	0.22	0.65	0.62	0.60	0.71	0.47	1.08	0.93	0.76	0.40	1.23	0.60
TOTAL PYRROPHYTA	100	312	117	373	178	89	27	41	22	9	6	5	8	6		3	5
Ceratium hirundinella (O.F. Müll.) Dujardin							1	1			1	1	1	2		1	
Cystodinium sp.	2	11			11								1				
Glenodinium spp.	5	26		46	22		1	6					1				
Peridinium spp.	93	263	87	327	141	64	25	34	22	9	5	4	5	4		2	5
Dinoflagellate cysts		12	30		4	25											
PYRROPHYTA, percent composition in total phytoplankton	4.68	2.76	1.12	5.36	3.79	0.62	2.86	3.95	1.82	1.04	1.16	1.08	0.45	0.91		0.34	0.99
TOTAL FLAGELLATES	144	562	407	705	382	110	55	46	45	56	4	1	30	4		9	10
Chlamydomonas sp.			67	195	100	28	6	12	33	31	2					5	4
Cryptomonas sp.	137	501	274	482	256	57	38	31	12	25	2	1	30	4		4	6
Euglena spp.	7	52	51	28	7	8	11	3									
Lepocinclis spp.																	

(cont.)

Table 3 (cont.)

MONTH	August 1969																
STATION		FP			MP			EP			LAKE(1)				LAKE(2)		
DEPTH, METERS	1	6	8	1	5	9	1	5.5	7	1	5	11	16.5	1	5	18	26
Pteromonas sp.		9	15		19	17											
Phacus sp.																	
Undetermined flagellates																	
FLAGELLATES, percent composition in total phytoplankton	6.77	4.97	3.87	10.12	8.13	0.76	5.78	4.44	3.64	6.74	0.70	0.26	1.64	0.61		0.83	2.20

Table 4a Phytoplankton, Numbers of Identified Taxa.

September 1968

Station	FP		Total at Station	MP		Total at Station	EP		Total at Station	LAKE(5)		Total at Station	LAKE(1)			Total at Station	Total for September
Depth (m)	1	6.6		1	6		1	6.6		1	8		1	10	17		
TOTAL DIATOMS	69	53	83	103	86	121	64	66	80	87	73	98	36	22	60	66	182
Genus *Achnanthes* Bory	6	4	6	7	3	8	4	7	7	8	6	8	1		3	3	11
G. *Amphora* Ehr.	2	2	2	9	8	9	6	7	7	6	6	6	1	1	5	5	9
G. *Cocconeis* Ehr.	3	2	3	5	3	5	3	4	4	3	4	5		1	3	3	6
G. *Cymbella* Agardh	2	1	2	4	3	7	3		3	1		1	1			1	13
G. *Gomphonema* Agardh	3	2	3	4	3	5	1	1	1		2	2	1		3	3	6
G. *Navicula* Bory	13	6	15	14	17	21	12	11	14	22	16	26	3	2	6	7	39
G. *Nitzschia* Hass.	8	11	15	16	13	18	7	6	9	12	8	12	2	2	5	5	26
Fragilariaceae*	14	9	16	13	13	14	11	12	14	14	13	15	12	8	13	16	28
Centric diatoms	14	11	14	16	14	17	14	12	14	15	13	15	15	8	16	17	19
Various rare diatom species	4	5	7	13	9	17	3	6	7	6	5	7			6	6	25
TOTAL GREENS	52	52	63	51	40	61	31	41	51	30	40	44	26	21	13	41	84
TOTAL BLUE-GREENS	4	1	4	5	4	6	4	11	11	5	5	5	5	5	6	8	14
TOTAL CHRYSOPHYTA		2	2		4	4	2	2	2	3	3	3	2	2		2	4
TOTAL PYRROPHYTA	2	1	2	1	2	2	1	3	3	1	1	1	2	2	1	2	4
TOTAL FLAGELLATES	4	3	4	3	4	4	4	2	4	3	2	3	2	2	2	2	5
TOTAL	131	112	158	161	140	198	106	125	151	129	124	154	73	54	67	121	293

*Fragilariaceae include genera: *Synedra* Ehr., *Fragilaria* Lyngb., *Tabellaria* Ehr., *Asterionella* Hass., *Diatoma* Bory

Table 4b Phytoplankton, Numbers of Identified Taxa. October 1968

Station	FP		Total at Station	MP		Total at Station	EP		Total at Station	LAKE		Total at Station	Total for October
Depth (m)	1	7.5		1	7		1	6.6		1	9		
TOTAL DIATOMS	76	64	88	82	72	94	79	104	119	77	49	88	171
Genus *Achnanthes* Bory	6	7	7	8	8	9	5	9	9	7	2	8	14
G. *Amphora* Ehr.	4	4	5	7	5	7	7	7	8	4	4	5	9
G. *Cocconeis* Ehr.	4	4	4	4	3	4	2	4	4	2	2	2	4
G. *Cymbella* Agardh	2	1	2		2	2	1	1	1	8	1	8	10
G. *Gomphonema* Agardh	3	2	3	2	2	2	2	3	3	5	1	5	7
G. *Navicula* Bory	11	7	12	13	11	16	13	19	22	8	5	10	31
G. *Nitzschia* Hass.	12	11	15	12	9	15	10	13	17	8	5	9	25
Fragilariaceae*	19	12	20	14	12	15	16	19	20	13	15	17	27
Centric diatoms	11	10	11	18	16	18	17	16	18	15	11	15	21
Various rare diatom species	4	6	9	4	4	6	6	13	17	7	3	9	23
TOTAL GREENS	38	34	43	30	32	42	34	31	43	28	23	37	63
TOTAL BLUE-GREENS	2	2	3	3	2	3	5	7	7	7	9	12	[illegible]
TOTAL CHRYSOPHYTA	1	1	2	2	2	3	1	1	1	2	2	3	6
TOTAL PYRROPHYTA				2	1	2	1	1	1	1	1	1	2
TOTAL FLAGELLATES	6	4	6	6	6	6	5	6	6	3	3	4	6
TOTAL	123	105	142	125	115	150	125	150	177	118	87	145	261

Table 4c Phytoplankton, Numbers of Identified Taxa

November 1968

Station	FP		Total at Station	MP			Total at Station	EP(1)			Total at Station	EP(2)			Total at Station	LAKE				Total at Station	Total for November
Depth (m)	1	6.6		1	7	9		1	5	9		1	5	9		1	10	25	28		
TOTAL DIATOMS	112	95	128	55	76	122	140	42	74	89	100	29	34	108	110	42	32	84	75	108	211
Genus *Achnanthes* Bory	11	11	13	2	9	13	15	2	3	7	8	1	2	8	8	1	2	7	8	10	20
G. *Amphora* Ehr.	5	5	6	5	7	6	7	2	5	6	6	1	4	7	7	3	2	6	4	6	7
G. *Cocconeis* Ehr.	6	6	6	3	4	7	7	1	3	4	4			6	6	1		5	4	5	9
G. *Cymbella* Agardh	6	5	7	1	3	3	4							3	3			1		1	10
G. *Gomphonema* Agardh	5	2	5	1	3	3	4			1	1	1	2	3	4			3	1	3	8
G. *Navicula* Bory	20	22	28	8	11	28	33	7	10	12	14	3	2	26	26	3	3	17	10	20	45
G. *Nitzschia* Hass.	11	7	11	2	2	12	13	4	9	5	10	2	2	6	6	2	2	4	7	9	22
Fragilariaceae*	22	18	24	13	17	21	24	11	16	24	26	7	8	18	18	14	9	15	16	23	38
Centric diatoms	13	13	15	18	16	20	21	14	23	16	23	14	14	19	20	15	13	19	19	21	26
Various rare diatom species	13	6	13	2	6	9	14	1	5	4	8			12	12	3	1	6	6	10	26
TOTAL GREENS	17	15	21	14	20	18	31	5	21	14	31	8	10	18	20	19	15	22	30	43	55
TOTAL BLUE-GREENS	1	1	1	4	4	3	6	4	5	6	8	5	5	3	6	7	5	4	5	9	12
TOTAL CHRYSOPHYTA	1	1	1	2	2		3	1	1	1	2		1	1	1	2	1	1	2	3	4
TOTAL PYRROPHYTA	1		1	1	1	1	1			1	1					1				1	1
TOTAL FLAGELLATES	3	5	5	2	2	4	4	2	3	2	3	2	2	3	3	5	3	2	5	5	5
TOTAL	135	117	157	78	105	148	185	54	104	113	145	44	52	133	140	76	56	113	117	169	222

Table 4d Phytoplankton, Numbers of Identified Taxa

Station	FP			MP			EP			LAKE			
	March 1969												
Depth (m)	1	6.6	Total at Station	1	7.5	Total at Station	1	14.2	Total at Station	1	19	Total at Station	Total in March
TOTAL DIATOMS	120	111	145	88	88	112	67	101	108	35	50	54	181
Genus *Achnanthes* Bory.	13	9	13	8	6	9	3	8	8	3	3	4	14
G. *Amphora* Ehr.	4	6	7	6	5	7	3	4	4	1	4	4	7
G. *Cocconeis* Ehr.	6	6	6	6	5	6	1	4	4	1	1	1	7
G. *Cymbella* Agardh	3	3	4		1	1	2	2	3	.	1	1	4
G. *Gomphonema* Agardh	5	3	6	1	3	3	1	2	2		1	1	6
G. *Navicula* Bory	26	21	30	14	16	22	10	21	23	3	5	6	38
G. *Nitzschia* Hass.	16	13	18	8	7	9	8	9	9	2	5	5	24
Fragilariaceae*	25	27	32	20	22	26	15	22	22	10	14	14	39
Centric diatoms	12	13	16	19	18	21	18	18	21	13	12	13	23
Various rare diatom species	10	10	13	6	5	8	6	11	12	2	4	5	19
TOTAL GREENS	5	6	8	7	4	7	9	2	9	5	4	5	12
TOTAL BLUE-GREENS	1	1	1		1	1	2	2	2	3	1	3	4
TOTAL CHRYSOPHYTA	1	1	1		1	1	1	1	1	1	1	1	1
TOTAL PYRROPHYTA	1	1	1		1	1	1	1	1				1
TOTAL FLAGELLATES	3	4	4	2	2	2	2	2	2	2	2	2	4
TOTAL	131	124	160	97	97	124	82	109	123	46	58	65	203

Table 4e Phytoplankton, Numbers of Identified Taxa

April 1969

Station	PP		Total at Station	MP			Total at Station	EP		Total at Station	LAKE			Total at Station	Total in April
Depth (m)	1	6.6		1	6	14.5		1	15.7		1	14	25		
TOTAL DIATOMS	123	167	181	164	130	129	194	67	87	105	46	78	76	109	254
Genus *Achnanthes* Bory	14	12	14	12	11	11	12	1	8	8	2	5	5	8	15
G. *Amphora* Ehr.	6	7	8	5	5	5	5	1	5	5	1	2	4	5	9
G. *Cocconeis* Ehr.	6	6	6	7	6	6	7	2	4	4	1	3	1	3	7
G. *Cymbella* Agardh	8	6	8	5	5	7	8		4	4		1	1	1	12
G. *Gomphonema* Agardh	5	9	10	10	6	3	10	2	1	2	1	1	1	1	14
G. *Navicula* Bory	27	42	45	35	24	25	44	8	11	15	3	15	12	21	60
G. *Nitzschia* Hass.	8	15	15	15	10	11	20	9	7	10	2	6	6	8	24
Fragilariaceae*	26	34	36	36	29	28	41	19	25	27	17	25	24	33	54
Centric diatoms	12	13	15	20	22	20	22	17	18	21	17	16	16	20	22
Various rare diatom species	11	23	24	19	12	13	25	8	4	9	2	4	6	9	37
TOTAL GREENS	3	9	9	6	8	4	10	4	2	5	2	4	4	7	16
TOTAL BLUE-GREENS		1	1	2	1	2	3	1	1	1	2	2	1	2	3
TOTAL CHRYSOPHYTA		1	1	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL PYRROPHYTA					1	1	1	1	1	1	1	1	1	1	1
TOTAL FLAGELLATES	3	3	3	3	3	2	3	2	2	2	2	3	2	3	3
TOTAL	129	181	195	176	144	139	212	76	94	115	54	89	85	123	278

Table 4f Phytoplankton, Numbers of Identified Taxa

May 1969

Station	PP		Total at station	MP			Total at Station	EP			Total at Station	LAKE			Total at Station	Total in May
Depth (m)	1	6.6		1	5	13		1	5	16		1	10	85		
TOTAL DIATOMS	140	144	172	126	154	125	194	143	83	64	156	70	63	69	103	254
Genus *Achnanthes* Bory	11	11	13	8	9	10	13	11	3	4	11	4	3	1	7	17
G. *Amphora* Ehr.	5	4	5	6	7	5	8	5	2	4	5	2		2	3	8
G. *Cocconeis* Ehr.	7	7	7	4	7	6	7	6	3	1	7		1	1	2	7
G. *Cymbella* Agardh	4	4	5	1	4	2	4	7	1		7			1	1	10
G. *Gomphonema* Agardh	4	5	6	3	8	4	8	4	2	1	4		1		1	10
G. *Navicula* Bory	31	28	36	22	26	22	38	29	10	5	29	8	5	9	16	52
G. *Nitzschia* Hass.	13	19	21	14	13	13	16	10	8	4	12	9	7	6	11	25
Fragilariaceae*	35	35	41	34	41	32	51	31	26	16	35	20	22	21	29	59
Centric diatoms	16	15	17	23	21	21	26	23	21	23	26	23	21	22	24	23
Various rare diatom species	14	16	21	11	18	10	23	17	7	6	20	4	3	6	9	38
TOTAL GREENS	15	14	16	13	33	17	39	29	19	13	38	12	5	12	17	48
TOTAL BLUE-GREENS	1	1	1	1	3	3	4	2	2	2	3	1	2	1	2	6
TOTAL CHRYSOPHYTA	1	1	1	1	2	3	3	2	3		3	2	1	2	2	3
TOTAL PYRROPHYTA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL FLAGELLATES	3	3	4	3	2	2	3	3	2	3	4	3	2	2	3	5
TOTAL	161	164	195	145	195	151	244	180	110	83	205	89	74	87	128	327

Table 4g Phytoplankton, Numbers of Identified Taxa

June 1969

Station	PP		Total at Station	MP			Total at Station	EP		Total at Station	LAKE		Total at Station	Total in June
Depth (m)	1	8		1	5	11		1	16		1	20		
TOTAL DIATOMS	130	156	179	157	162	109	211	173	112	189	65	94	114	284
Genus *Achnanthes* Bory	12	16	17	8	9	6	10	14	9	15	1	5	5	20
G. *Amphora* Ehr.	4	4	4	9	9	7	11	10	5	10	2	4	4	12
G. *Cocconeis* Ehr.	7	7	8	5	6	4	6	6	5	6	1	4	4	8
G. *Cymbella* Agardh	6	6	7	8	4	2	9	6	2	6	2	5	6	11
G. *Gomphonema* Agardh	10	6	11	7	4	4	9	7	3	7	1	2	2	15
G. *Navicula* Bory	25	30	36	37	35	19	52	39	21	45	7	17	19	69
G. *Nitzschia* Hass.	12	15	16	18	13	7	21	17	8	17	4	5	7	25
Fragilariaceae*	26	38	42	31	41	36	45	39	27	43	22	26	34	58
Centric diatoms	14	15	15	19	22	17	22	21	21	22	20	19	23	24
Various rare diatom species	14	19	23	15	19	7	26	14	11	18	5	7	10	42
TOTAL GREENS	35	29	37	32	26	15	40	31	18	34	23	19	29	51
TOTAL BLUE-GREENS	1	3	3	2	2	2	3	1	1	1	4	4	8	9
TOTAL CHRYSOPHYTA	1	3	3	3	3	4	4	4	3	4	3	3	4	5
TOTAL PYRROPHYTA		1	1	1	1	1	1	1	1	1	1	2	2	2
TOTAL FLAGELLATES	4	5	6	5	4	2	5	5	2	5	2	3	3	6
TOTAL	171	197	229	200	198	133	264	215	137	234	98	125	160	357

Table 4h Phytoplankton, Numbers of Identified Taxa

July 1959

Station	PP		Total at Station	MP(4)		Total at Station	MP(1)		Total at Station	EP			Total at Station	LAKE			Total at Station	Total in July
Depth (m)	1	8		1	14		1	15		1	8	15		1	14	31		
TOTAL DIATOMS	145	152	189	114	109	150	95	53	110	87	48	57	117	29	43	87	104	259
Genus *Achnanthes* Bory	12	11	12	9	6	10	8	2	8	5		1	5	1		6	7	27
G. *Amphora* Ehr.	6	5	7	4	2	4	3	1	3	3	1	3	4		2	5	6	9
G. *Cocconeis* Ehr.	7	7	7	4	4	5	6	2	6	3	1	3	4	1	2	5	5	7
G. *Cymbella* Agardh	5	8	9	4		4	4	1	5	1		1	1			2	2	11
G. *Gomphonema* Agardh	7	6	7	6	5	7	4	3	5	4			4	1	1	3	3	9
G. *Navicula* Bory	36	36	46	27	23	36	16	3	17	14	4	11	24		4	12	14	61
G. *Nitzschia* Hass.	13	16	19	15	17	22	8	6	11	10	2	3	14	2	2	5	7	29
Fragilariaceae*	25	27	34	25	24	30	18	15	24	24	16	12	29	7	14	22	28	49
Centric diatoms	15	14	16	15	20	20	20	17	22	20	22	19	25	17	16	21	24	27
Various rare diatom species	19	22	32	5	8	12	8	3	9	3	2	4	7		2	6	8	40
TOTAL GREENS	38	46	55	37	41	49	42	32	51	42	34	18	48	25	20	10	34	82
TOTAL BLUE-GREENS		3	3	4	4	5	5	4	5	5	3	2	5	7	3	3	9	14
TOTAL CHRYSOPHYTA	2	2	3	2	6	6	4	4	4	4	5	2	6	3	2	2	3	6
TOTAL PYRROPHYTA	1	2	2	1	3	3	2	1	2	2	1	1	2	1	2	2	2	4
TOTAL FLAGELLATES	4	4	4	4	4	5	2	2	2	2	2	1	2	3	2	2	3	5
TOTAL	190	209	256	162	167	218	150	96	174	142	93	81	180	68	72	106	155	370

Table 41 Phytoplankton, Numbers of Identified Taxa

August 1969

Station	PP			Total at Station	MP			Total at Station	EP			Total at Station	LAKE(1)				Total at Station	LAKE(2)				Total at Station	Total in August
Depth (m)	1	6	8		1	5	9		1	5.5	7		1	5	11	16.5		1	5	18	25		
TOTAL DIATOMS	139	185	172	233	129	168	220	251	112	133	139	184	6	19	17	30	43	19	9	25	30	48	306
Genus *Achnanthes* Bory	10	14	11	16	10	13	16	16	6	7	9	12			1		1				2	2	21
G. *Amphora* Ehr.	5	6	5	8	6	8	9	9	8	6	7	9			1	2	3			2	1	3	11
G. *Cocconeis* Ehr.	6	7	7	7	7	5	8	8	6	6	5	6		1	1		1			2	1	3	8
G. *Cymbella* Agardh	6	9	8	11	3	6	9	11	2	5	5	8						1				1	14
G. *Gomphonema* Agardh	7	11	9	13	9	10	12	17	4	5	2	6		1			1		1		1	2	19
G. *Navicula* Bory	30	43	37	50	25	39	56	64	24	34	28	44		2		3	4	1	2	2	2	4	73
G. *Nitzschia* Hass.	15	21	22	28	15	18	22	24	7	14	16	20				3	3			1		2	32
Fragilariaceae*	32	33	32	40	28	35	41	46	21	26	29	31	2	4	4	9	12	7	2	7	7	10	50
Centric diatoms	17	17	19	26	18	20	17	23	17	17	20	22	3	11	10	12	16	10	4	9	14	17	27
Various rare diatom species	11	24	22	33	8	14	30	33	17	13	18	26	1			1	2			2	2	4	51
TOTAL GREENS	40	55	55	68	53	57	53	74	58	53	35	76	38	31	39	50	62	30	26	34	21	49	109
TOTAL BLUE-GREENS			2	2	5	5	7	7	8	9	6	11	6	5	9	8	9	5	6	5	4	8	11
TOTAL CHRYSOPHYTA	2	2	2	3	2	2	2	3	2	1	1	2	2	1	1	2	2	2	1	2	2	2	3
TOTAL PYRROPHYTA	3	4	2	4	2	4	2	4	3	3	1	3	1	2	2	4	4	2		2	1	2	5
TOTAL FLAGELLATES	2	3	4	4	3	4	4	4	3	3	2	3	2	2	1	1	2	1		2	2	2	4
TOTAL	186	249	237	314	194	240	288	343	186	202	184	279	55	60	69	95	122	59	42	70	60	111	433

26 September 1968

Table 5a(1) Physical Data

Station		PP	MP	EP	LAKE(5)	LAKE(1)
Weather		Partly cloudy 80% sky cover	Partly cloudy	Partly cloudy	Partly cloudy	High Clouds
Surface water temperature, °C		19.8	19.1	18.8	18.9	19.7
Surface light*		7000	2960	2400	4480	3600
Bottom depth (m)		6.6	6	6.6	8	17
Secchi Disc	Max. depth of visibility (m)	0.7	1.3	3	2.5	4.5
	Corresponding light intensity	~150	200	55	37	1000
	Water color	Dirty,yellowish brown	Dirty brown	Somewhat dirty,yellowish green-brown	Dirty yellowish green	Milky light green
	Percent of surface light at disc depth	2.14	6.75	2.29	0.82	27.77
Percent of river water** in the mixing area (MP,EP)	Surface		57.0	10.0		
	Bottom		35.0	12.0		
	Average		46.0	11.0		

Table 5a(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP	EP	LAKE(5)	LAKE(1)
Dissolved O_2	7.5	8.0	8.8	8.8	8.6
CO_2	2.0	4.0	3.0	2.0	2.5
pH	8.60	8.63	8.50	8.55	8.53
Total Alkalinity as $CaCO_3$	213	140	120	122	118
NO_3-N, ppb	226.5	122.5	100.0	109.0	123.2
NO_2-N, ppb	25.0	12.0	4.5	6.5	3.5
Ortho PO_4, ppb	72.25	9.35	4.05	4.35	4.37
Silica	0.65	0.69	0.68	0.62	0.53
Sulfate	59	40	25	27	22
Chloride	41.2	21.5	14.3	15.0	9.2
Turbidity***	20.9	8.3	4.2	4.3	2.32

* Light intensity is expressed in microamperes. The Submarine Photometer No. 268 WA300 (G. M. Mfg. and Instrument Corp.) used for light measurements had an output of approximately four microamperes per foot candle of incandescent light.

** Percent of river water was calculated on the basis of values for chloride and sulfate. Averages are for the water column, often include more measurements than at the surface and bottom.

*** SiO_2 ppm, on the Hellige scale.

15 October 1968

Table 5b(1) Physical Data

Station		PP	MP	EP	LAKE
Weather		Clear sky warm	Hazy warm	Hazy warm	Hazy Warm
Surface water temperature, °C		16.0	16.3	16.9	16.3
Surface light*		3100	2020	2680	4000
Bottom depth (m)		7.5	7	6.6	9
Secchi Disc: Max. depth of visibility (m)		0.8	1.9	2.2	4.7
Secchi Disc: Corresponding light intensity		~100	40	80	100
Secchi Disc: Water color		Dirty, brown	Dirty, brown	Slightly milky, green-brown	Slightly milky, light green
Secchi Disc: Percent of surface light at disc depth		3.22	1.98	2.98	2.50
Percent of river water** in the mixing area (MP,EP)	Surface		31.0	13.0	
	Bottom		25.0	13.0	
	Average		28.0	13.0	

Table 5b(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP	EP	LAKE
Dissolved O_2	6.7	5.5	6.0	7.5
CO_2				
pH	8.59	8.60	8.55	8.53
Total Alkalinity as $CaCO_3$	227	140	120	105
NO_3-N, ppb	373.0	200.0	160.0	125.0
NO_2-N, ppb	35.0	16.0	5.5	8.0
Ortho PO_4, ppb	61.43	14.5	3.35	4.75
Silica	5.00	1.71	1.03	0.92
Sulfate	70	36	27	23
Chloride	40	18.7	15.0	10.0
Turbidity***	15.0	8.0	5.85	2.85

6 November 1968

Table 5c(1) Physical Data

Station		PP	MP	EP(1)	EP(2)	LAKE
Weather		Light rain	Light rain	Middle height clouds	Overcast, hazy, middle ht. clouds	Overcast, hazy, 80% sky cover
Surface water temperature, °C		10.0	12.0	12.0	12.0	12.5
Surface light*		1000	1020	1400	300	200
Bottom depth (m)		6.6	9	9	9	28
Secchi Disc: Max. depth of visibility (m)		1.2	4.5	3.5	5	7.5
Secchi Disc: Corresponding light intensity		50	20	67	20	4.5
Secchi Disc: Water color		Dirty, yellowish brown	Slightly milky, green	Dirty, yellowish green	Clear green	Clear green
Secchi Disc: Percent of surface light at disc depth		5.00	1.96	4.78	6.66	2.25
Percent of river water** in the mixing area (MP, EP)	Surface		0.0	0.0	0.0	
	Bottom		21.0	0.0	0.0	
	Average		8.0	0.0	0.0	

Table 5c(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP	EP(1)	EP(2)	LAKE
Dissolved O_2	6.0	7.0	7.7	8.0	8.0
CO_2		no	data		
pH	8.52	8.48	8.56	8.53	8.50
Total Alkalinity as $CaCO_3$	223	122	103	110	109
NO_3-N, ppb	570.0	151.6	150.6	133.3	173.2
NO_2-N, ppb	32.5	5.5	1.3	4.3	3.8
Ortho PO_4, ppb	86.70	22.53	2.43	1.83	3.40
Silica	8.10	1.73	0.81	0.95	1.29
Sulfate	73	26	22	22	22
Chloride	46.3	14.2	11.6	10.8	12
Turbidity ***	10.4	3.73	2.36	2.33	3.14

18 March 1969

Table 5d(1) Physical Data

Station		PP	MP	EP	LAKE
Weather		Clear sky sun	Clear sky sun	Clear sky sun	Clouds start to appear
Surface water temperature, °C		4.2	2.0	2.0	2.5
Surface light*		6000	7160	6400	2600
Bottom depth (m)		6.6	7.5	14.2	19
Secchi Disc	Max. depth of visibility (m)	1.3	1.5	2.5	3.5
	Corresponding light intensity	105	1000	850	250
	Water color	Green brown	Dark green	Brown green, milky	Milky green
	Percent of surface light at disc depth	1.75	13.96	13.28	9.61
Percent of river water** in the mixing area (MP,EP)	Surface		38.0	12.0	
	Bottom		46.0	19.0	
	Average		42.0	15.0	

Table 5d(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP	EP	LAKE
Dissolved O_2	12.0	12.0	12.0	12.0
CO_2		no	data	
pH	8.90	8.83	8.88	8.85
Total Alkalinity as $CaCO_3$	190	145	140	120
NO_3-N, ppb	748.0	405.0	240.0	234.0
NO_2-N, ppb	19.0	4.0	3.5	1.5
Ortho PO_4, ppb	107.3	35.6	17.8	11.8
Silica	7.27	5.75	6.00	1.96
Sulfate	67	41	28	24
Chloride	35.0	22.5	16.2	11.3
Turbidity ***	6.05	4.5	4.0	2.55

17 April 1969

Table 5c(1) Physical Data

Station		PP	MP	EP	LAKE
Weather		Light rain heavy overcast	Clouds, heavy fog, rain	Heavy fog	Heavy fog
Surface water temperature, °C		13.0	9.0	4.5	4.0
Surface light*		200	650	2000	4200
Bottom depth (m)		6.6	14.5	15.7	25
Secchi Disc: Max. depth of visibility (m)		0.5	1.5	2.8	4
Secchi Disc: Corresponding light intensity		9	60	280	350
Secchi Disc: Water color		Dirty, yellow brown	Clear brown	Greyish green, dirty	Green
Secchi Disc: Percent of surface light at disc depth		4.50	9.23	14.00	8.33
Percent of river water** in the mixing area (MP,EP)	Surface		26.0	0.0	
	Bottom		0.0	0.0	
	Average		5.0	0.0	

Table 5c(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP	EP	LAKE
Dissolved O_2	10.0	10.7	12.5	12.0
CO_2	13.0	4.0	6.0	6.0
pH	8.80	8.83	8.90	8.87
Total Alkalinity as $CaCO_3$	185	143	110	123
NO_3-N, ppb	1060.0	363.3	260.0	343.3
NO_2-N, ppb	30.0	8.6	6.5	7.3
Ortho PO_4, ppb	47.1	17.06	6.55	9.93
Silica	4.25	1.62	1.40	2.03
Sulfate	76	35	28	30
Chloride	30	14.2	10.0	14.2
Turbidity ***	12.65	6.06	4.15	5.53

29 May 1969

Table 5f(1) Physical Data

Station		PP	MP	EP	LAKE
Weather		Fair, no clouds	Few clouds	Clear sky, sun	Blue sky, hazy sun
Surface water temperature, °C		19.0	11.5	10.5	10.5
Surface light*		2800	5000	5600	7600
Bottom depth (m)		6.6	13	16	25
Secchi Disc	Max. depth of visibility (m)	0.7	2	4	4.5
	Corresponding light intensity	~90	105	25	220
	Water color	Dirty, yellow-brown	Yellowish-brown	Rather clear, yellowish-green	Rather clear, yellowish-green
	Percent of surface light at disc depth	3.21	2.10	0.44	2.89
Percent of river water** in the mixing area (MP,EP)	Surface		20.0	0.0	
	Bottom		0.0	0.0	
	Average		13.0	3.0	

Table 5f(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP	EP	LAKE
Dissolved O_2	7.5	9.7	10.3	10.3
CO_2	6.0	4.0	2.7	2.7
pH	8.80	8.78	8.82	8.80
Total Alkalinity as $CaCO_3$	170	117	123	115
NO_3-N, ppb	485.0	216.6	180.0	163.3
NO_2-N, ppb	12.5	4.0	5.3	1.6
Ortho PO_4, ppb	39.4	3.93	3.80	0.93
Silica	5.05	1.26	0.95	0.67
Sulfate	58	28	22	22
Chloride	22.5	11.6	10.5	10.0
Turbidity***	8.2	7.33	6.43	6.03

23 June 1969

Table 5g(1) Physical Data

Station		PP	MP	EP	LAKE
Weather		Light rain, mist	Foggy	Stratus clouds	Stratus clouds
Surface water temperature, °C		18.8	15.9	15.4	13.1
Surface light*		1000	2000	1600	2240
Bottom depth (m)		8	11	16	20
Secchi disc	Max. depth of visibility (m)	0.7	1.8	2	3.5
	Corresponding light intensity	~150	70	40	170
	Water color	Dirty brown	Yellowish brown	Rather clear yellow-brown	Rather clear, greenish
	Percent of surface light at disc depth	15.0	3.50	2.50	7.58
Percent of river water** in the mixing area (MP,EP)	Surface		27.0	20.0	
	Bottom		11.0	6.0	
	Average		16.0	13.0	

Table 5g(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP	EP	LAKE
Dissolved O_2	7.5	9.7	10.5	10.0
CO_2	8.0	3.3	2.0	3.0
pH	8.78	8.74	8.74	8.79
Total Alkalinity as $CaCO_3$	230	132	140	120
NO_3-N, ppb	520.0	160.0	200.0	130.0
NO_2-N, ppb	21.5	4.6	6.5	2.5
Ortho PO_4, ppb	71.4	5.6	9.55	0.45
Silica	6.37	1.16	1.43	0.66
Sulfate	63	28	27	24
Chloride	26.3	13.3	12.5	8.8
Turbidity***	14.45	6.1	4.75	3.5

25 July 1969

Table 5h(1) Physical Data

Station		PP	MP(4)	MP(1)	EP	LAKE
Weather		Sun, white cumulus clouds	Clear sky sun	Sun, few clouds	Clear sky sun	Sun, few clouds
Surface water temperature, °C		27.0	23.8	20.6	22.6	22.4
Surface light*		7200	5600	7400	10400	10400
Bottom depth (m)		8	14	15	15	31
Secchi Disc	Max. depth of visibility (m)	0.6	2	2.5	2.7	5.8
	Corresponding light intensity	70	500	550	1850	650
	Water color	Dark brown	Olive brown	Yellowish green	Yellowish green	Clear green
	Percent of surface light at disc depth	0.97	8.92	7.43	17.78	6.25
Percent of river water** in the mixing area (MP,EP)	Surface		19.0	13.0	7.0	
	Bottom		18.0	1.0	4.0	
	Average		18.0	1.0	7.0	

Table 5h(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP(4)	MP(1)	EP	LAKE
Dissolved O_2	10.5	11.0	11.0	10.0	9.7
CO_2	1.3	0.0	2.5	1.6	2.1
pH	8.91	8.89	8.81	8.83	8.77
Total Alkalinity as $CaCO_3$	217	138	130	132	127
NO_3-N, ppb	266.6	100.0	105.0	113.3	163.3
NO_2-N, ppb	24.3	8.0	4.2	2.3	5.0
Ortho PO_4, ppb	64.3	0.95	0.12	0.0	0.76
Silica	2.01	0.46	0.38	0.53	0.92
Sulfate	71	30	22	26	24
Chloride	34.2	15.0	10.1	12.5	10.0
Turbidity ***	12.55	4.65	3.7	3.76	4.0

29 August 1969

Table 51(1) Physical Data

Station		PP	MP	EP	LAKE(1)	LAKE(2)
Weather		Stratus clouds, fog	Fog	Fog	Light fog, sun	Light fog
Surface water temperature, °C		24.9	24.2	23.2	23.7	23.8
Surface light*		1000	4800	5200	4400	2000
Bottom depth (m)		8	9	7	16.5	26
Secchi Disc: Max. depth of visibility (m)		0.7	1.5	3.5	4	5
Secchi Disc: Corresponding light intensity		70	350	300	700	350
Secchi Disc: Water color		Dirty brown	Yellow-brown	Quite clear yellowish-green	Green, clear	Milky green
Secchi Disc: Percent of surface light at disc depth		7.00	7.29	5.76	15.90	17.50
Percent of river water** in the mixing area (MP,EP)	Surface		47.0	0.0		
	Bottom		52.0	0.0		
	Average		49.0	0.0		

Table 51(2) Average Chemical Results, ppm (NO_3, NO_2 and Ortho-PO_4 are expressed as ppb.)

Station	PP	MP	EP	LAKE(1)	LAKE(2)
Dissolved O_2	4.3	7.0	9.3	9.3	9.0
CO_2	12.0	5.3	2.0	0.6	2.5
pH	8.79	8.80	8.80	8.80	8.79
Total Alkalinity as $CaCO_3$	197	147	110	111	111
NO_3-N, ppb	33.3	56.6	36.6	22.5	100.0
NO_2-N, ppb	4.3	5.0	0.6	3.7	2.5
Ortho PO_4, ppb	62.1	21.1	0.0	0.07	0.12
Silica	2.22	1.06	0.49	0.40	0.94
Sulfate	72	43	22	23	23
Cnloride	42.5	27.5	9.2	10.0	10.0
Turbidity***	21.53	7.26	6.36	3.67	3.95

Table 6 Individual Chemical Values and Temperature Measurements

Table 6(a) Dissolved O_2 Values, ppm.

Station	Depth (m)	Fall 1968 Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Spring 1969 Mar.	Apr.	May	June	Summer 1969 July	July(1)	Aug.	Aug.(2)
Power Plant	1	7.0		6.0	6.0		12.0	10.0	8.0	8.0	10.0		5.0	
	4													
	5										(12.0)			
	6			(6.0)										
	bottom value	8.0		8.0	6.0		12.0	10.0	7.0	7.0	9.5		4.0 4.0	
	average value	7.5		6.7	6.0		12.0	10.0	7.5	7.5	10.5		4.3	
Eng. Dock	1			7.0	6.0									
	3	10.0						8.0	8.0	7.0	10.0			
	5			8.0	6.0									
	bottom value			7.0	6.0									
	average value			7.3	6.0									
Middle Plume	1	9.1		5.0	7.0		12.0	10.0	10.0	9.0	11.0	12.0	8.0	
	5													
	6								9.0	10.0			8.0	
	7				7.0			11.0				(11.0)		
	10													
	bottom value	6.9		6.0	7.0		12.0	11.0	10.0	10.0	11.0	(11.0) 10.0	5.0	
	average value	8.0		5.5	7.0		12.0	10.7	9.7	9.7	11.0	11.0	7.0	

Values at Eng. Dock and values in parentheses were additional chemical analyses not matched by phytoplankton samples.

(cont.)

Table 6(a) (cont.)

Station	Depth (m)	Fall 1968					Spring 1969				Summer 1969			
		Sept.	Sept. (1)	Oct.	Nov.	Nov. (2)	Mar.	Apr.	May	June	July	July (1)	Aug.	Aug. (2)
Edge Plume	1	8.8		6.0	8.0	8.0	12.0	12.0	9.0	11.0	12.0		10.0	
	5				8.0	8.0			12.0					
	6												9.0	
	8										10.0			
	bottom value	8.8		6.0	7.0	8.0	12.0	13.0	10.0	10.0	8.0		9.0	
	average value	8.8		6.0	7.7	8.0	12.0	12.5	10.3	10.5	10.0		9.3	
Lake	1	8.8	8.9	6.0	8.0		12.0	12.0	10.0	10.0	10.0		9.0	9.0
	5												9.0	9.0
	10		8.8		8.0				10.0					
	11												9.0	
	13	(8.8)												
	14							12.0			10.0			
	18				(8.0)									9.0
	25				8.0									
	bottom value	8.8	8.0	9.0	8.0		12.0	12.0	11.0	10.0	9.0		10.0	9.0
	average value	8.8	8.6	7.5	8.0		12.0	12.0	10.3	10.0	9.7		9.3	9.0

Table 6(b) CO_2 Values, ppm

Station	Depth (m)	Fall 1968 Sept.	Sept. (1)	Oct.	Nov.	Nov. (2)	Spring 1969 Mar.	Apr.	May	Summer 1969 June	July	July (1)	Aug.	Aug. (2)
Power Plant	1	2.0						10.0	4.0	8.0	2.0		4.0	
	4										(0.0)			
	5													
	6												14.0	
	bottom value	2.0						16.0	8.0	8.0	2.0		12.0	
	average value	2.0						13.0	6.0	8.0	1.3		10.0	
Eng. Dock	1													
	3	8.0							2.0	8.0	0.0			
	5													
	bottom value													
	average value													
Middle Plume	1	4.0						4.0	6.0	4.0	0.0	2.0	6.0	
	5								4.0	2.0			2.0	
	6							4.0				(2.0)		
	7													
	10											(2.0)		
	bottom value	4.0						4.0	2.0	4.0	0.0	4.0	8.0	
	average value	4.0						4.0	4.0	3.3	0.0	2.5	5.3	

(cont.)

Table 6(b) (cont.)

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Edge	1	4.0						6.0	2.0	2.0	0.0		0.0	
Plume	5								2.0					
	6												2.0	
	8										0.8			
	bottom value	2.0						6.0	4.0	2.0	4.0		4.0	
	average value	3.0						6.0	2.7	2.0	1.6		2.0	
Lake	1	2.0	2.0					6.0	2.0	4.0	0.8		0.8	1.2
	5												0.8	0.4
	10		4.0						2.0					
	11												0.4	
	13		(2.0)											
	14							4.0			1.6			
	18													0.4
	25													
	bottom value	2.0	2.0					8.0	4.0	2.0	4.0		0.4	8.0
	average value	2.0	2.5					6.0	2.7	3.0	2.1		0.6	2.5

Table 6(c) pH Values

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Power Plant	1	8.65		8.65	8.53		8.90	8.80	8.80	8.83	8.95		8.82	
	4										(8.91)			
	5			8.60										
	6												8.80	
	bottom value	8.55		8.52	8.50		8.90	8.80	8.80	8.72	8.87		8.76	
	average value	8.60		8.59	8.52		8.90	8.80	8.80	8.78	8.91		8.79	
Eng. Dock	1	8.50		8.52	8.59		8.90	8.80	8.80	8.80	8.92		8.82	
	3	8.60												
	5			8.60	8.45									
	bottom value			8.52	8.50								8.80	
	average value	8.55		8.55	8.51								8.81	
Middle Plume	1	8.65		8.60	8.52		8.80	8.85	8.80	8.72	8.92	8.85	8.79	
	5								8.80	8.70			8.81	
	6							8.80				(8.89)		
	7				8.50									
	10											(8.83)		
	bottom value	8.60		8.60	8.42		8.85	8.85	8.75	8.80	8.86	8.68	8.79	
	average value	8.63		8.60	8.48		8.83	8.83	8.78	8.74	8.89	8.81	8.80	

(cont.)

Table 6(c) (cont.)

Station	Depth (m)	Fall 1968 Sept.	Sept. (1)	Oct.	Nov.	Nov. (2)	Spring 1969 Mar.	Apr.	May	Summer 1969 June	July	July (1)	Aug.	Aug. (2)
Edge Plume	1	8.45		8.50	8.65	8.60	8.90	8.90	8.80	8.81	8.90		8.80	
	5				8.50	8.50			8.90					
	6													
	8										8.82		8.80	
	bottom value	8.55		8.60	8.55	8.50	8.85	8.90	8.75	8.67	8.78		8.80	
	average value	8.50		8.55	8.56	8.53	8.88	8.90	8.82	8.74	8.83		8.80	
Lake	1	8.50	7.65	8.50	8.57		8.80	8.90	8.80	8.82	8.85		8.75	8.80
	5												8.80	8.80
	10		7.65		8.50				8.80					
	11												8.85	
	13		(8.40)											
	14							8.85			8.81			
	18				(8.50)									8.80
	25				8.50									
	bottom value	8.59	8.40	8.55	8.45		8.90	8.85	8.80	8.76	8.65		8.80	8.75
	average value	8.55	8.53	8.53	8.50		8.85	8.87	8.80	8.79	8.77		8.80	8.79

Table 6(d) Total Alkalinity Values, as ppm $CaCO_3$

		Fall 1968					Spring 1969			Summer 1969				
Station	Depth (m)	Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Power Plant	1	205		220	215		190	180	170	230	240		200	
	4										(245)			
	5			(235)										
	6												200	
	bottom value	220		225	230		190	190	170	230	165		190	
	average value	213		227	223		190	185	170	230	217		197	
Eng. Dock	1	220		195	235		180	160	200	200	240		205	
	3	215												
	5			195	230									
	bottom value			220	240								190	
	average value	218		203	235								198	
Middle Plume	1	150		140	110		120	160	110	140	145	140	155	
	5								130	130			135	
	6							140				(130)		
	7				110									
	10											(120)		
	bottom value	130		140	145		170	130	110	125	130	130	150	
	average value	140		140	122		145	143	117	132	138	130	147	

(cont.)

Table 6(d) (cont.)

Station	Depth (m)	Fall 1968 Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Spring 1969 Mar.	Apr.	May	Summer 1969 June	July	July(1)	Aug.	Aug.(2)
Edge Plume	1	115		120	100	110	120	110	120	160	140		110	
	5				110	110			130					
	6												110	
	8										125			
	bottom value	125		120	100	110	160	110	120	120	130		110	
	average value	120		120	103	110	140	110	123	140	132		110	
Lake	1	120	110	105	110		120	110	100	120	120		110	110
	5												110	110
	10		150		100				120					
	11												110	
	13		(95)											
	14							130			130			
	18				(110)									110
	25				110									
	bottom value	125	115	105	115		120	130	125	120	130		115	115
	average value	122	118	105	109		120	123	115	120	127		111	111

Table 6(e) NO_3 Values, ppb as N

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Power Plant	1	191		380	580		725	1200	480	450	280		60	
	4													
	5			(380)							(250)			
	6												20	
	bottom value	262		360	560		770	920	490	590	270		20	
	average value	226.5		373	570		748	1060	485	520	266.6		33.3	
Eng. Dock	1	261		400	480		725	1000	590	620	200		60	
	3	290												
	5			370	550									
	bottom value			370	550								110	
	average value	275.5		380	526.6								85	
Middle Plume	1	130		200	160		390	480	240	230	90	80	10	
	5									110			80	
	6													
	7							350	250			(60)		
	10				155									
	bottom value	115		200	140		420	260	160	140	110	(150) 130	80	
	average value	122.5		200	151.6		405	363.3	216.6	160	100	105	56.6	

(cont.)

Table 6(e) (cont.)

Station	Depth (m)	Fall 1968 Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Spring 1969 Mar.	Apr.	May	Summer 1969 June	July	July(1)	Aug.	Aug.(2)
Edge Plume	1	90		160	190	140	190	230	190	220	90		60	
	5				122	110			200					
	6												40	
	8										90			
	bottom value	110		160	140	150	290	290	150	180	160		10	
	average value	100		160	150.6	133.3	240	260	180	200	113.3		36.6	
Lake	1	108	122	110	150		170	250	160	110	90		20	90
	5												0.0	80
	10		92		160				140					
	11												50	
	13		(140)											
	14							290			160			
	18				(150)									50
	25				205									
	bottom value	110	139	140	201		298	490	190	150	240		20	180
	average value	109	123.2	125	173.2		234	343.3	163.3	130	163.3		22.5	100

Table 6(f) NO_2 Values, ppb as N

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept. 18	Sept.(1)	Oct. 38	Nov. 31	Nov.(2)	Mar. 18	Apr. 35	May 10	June 15	July 22	July(1)	Aug. 5	Aug.(2)
Power Plant	1													
	4										(25)			
	5			(38)										
	6												3	
	bottom value	32		29	34		20	25	15	28	26		5	
	average value	25		35	32.5		10	30	12.5	21.5	24.3		4.3	
Eng. Dock	1			45	35		22	26	20	33	30		9	
	3	36												
	5			33	31									
	bottom value			31	36								5	
	average value			36.3	34								7	
Middle Plume	1	12		19	8		4	15	3	10	11	11	2	
	5								4	0.0			5	
	6							6				(5)		
	7				3									
	10											(0.0)		
	bottom value	12		13			4	5	5	4	5	1	8	
	average value	12		16	5.5		4	8.6	4	4.6	8	4.2	5	

(cont.)

Table 6(f) (cont.)

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Edge Plume	1	5		5	1	6	2	10	8	8	5		1	
	5				0.0	6			5					
	6													
	8										0.0		0.0	
	bottom value	4		6	3	1	5	3	3	5	2		1	
	average value	4.5		5.5	1.3	4.3	3.5	6.5	5.3	6.5	2.3		0.6	
Lake	1	13	2	4	4		0.0	5	1	5	8		2	5
	5												5	0.0
	10		5		2				2					
	11												5	
	13		(5)											
	14							5			3			
	18				(1)									5
	25				5									
	bottom value	0.0	2	12	7		3	12	2	0.0	4		3	0.0
	average value	6.5	3.5	8	3.8		1.5	7.3	1.6	2.5	5		3.7	2.5

Table 6(g) Ortho-PO_4 Values, ppb

Station	Depth (m)	Fall 1968 Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Spring 1969 Mar.	Apr.	May	Summer 1969 June	July	July(1)	Aug.	Aug.(2)
Power Plant	1	75.0		75.8	89.8		107.3	46.7	40.2	54.9	61.5		48.6	
	4										(56.8)			
	5			(44.2)										
	6												65.2	
	bottom value	69.5		64.3	83.6		107.3	47.5	38.6	87.9	74.6		72.5	
	average value	72.25		61.43	86.7		107.3	47.1	39.4	71.4	64.3		62.1	
Eng. Dock	1			86.4	110.6		36.8	40.0	42.4	48.5	57.8		83.3	
	3	84.6												
	5			49.9	130.8									
	bottom value			53.8	91.0								41.2	
	average value			62.03	110.8								62.25	
Middle Plume	1	5.5		16.3	0.0		15.2	12.5	12.7	14.2	1.9	0.0	42.5	
	5								8.5	1.4			11.3	
	6							27.3				(0.0)		
	7				2.5									
	10											(0.5)		
	bottom value	13.2		12.7	65.1		56.0	11.4	0.6	1.2	0.0	0.0	9.5	
	average value	9.35		14.5	22.53		35.6	17.06	3.93	5.6	0.95	0.12	21.1	

(cont.)

Table 6(g) (cont.)

Station	Depth (m)	Fall 1968 Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Spring 1969 Mar.	Apr.	May	Summer 1969 June	July	July(1)	Aug.	Aug.(2)
Edge	1	4.1		1.9	6.1	1.2	0.0	9.6	7.4	19.1	0.0		0.0	
Plume	5				0.0	1.2			3.8					
	6													
	8										0.0		0.0	
	bottom value	4.0		4.8	1.2	3.1	35.6	3.1	0.2	0.0	0.0		0.0	
	average value	4.05		3.35	2.43	1.83	17.8	6.35	3.8	9.55	0.0		0.0	
Lake	1	4.1	6.5	9.5	2.5		9.1	9.7	1.3	0.9	2.3			
	5												0.0	0.0
	10		4.5		3.5								0.1	0.0
	11								1.0					
	13		(4.6)										0.0	
	14													
	18				(1.8)			1.6			0.0			
	25				4.3									0.5
	bottom value	4.6	1.9	0.0	4.9		14.5	18.5	0.5	0.0	0.0		0.2	0.0
	average value	4.35	4.37	4.75	3.4		11.8	9.93	0.93	0.45	0.76		0.07	0.12

Table 6(h) SiO_2 Values, ppm

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Power Plant	1	0.69		5.10	7.95		7.60	4.60	4.60	6.25	1.78		2.60	
	4													
	5			(4.80)							(2.10)			
	6												2.00	
	bottom value	0.62		5.10	8.25		6.95	3.90	5.50	6.50	2.15		2.05	
	average value	0.65		5.00	8.10		7.27	4.25	5.05	6.37	2.01		2.22	
Eng. Dock	1	1.45		4.78	8.40		7.85	4.95	4.50	5.75	1.45		1.78	
	3	1.30												
	5			5.20	8.40									
	bottom value			5.00	7.55								1.92	
	average value	1.37		4.99	8.11								1.85	
Middle Plume	1	0.67		1.92	1.09		5.10	2.00	1.60	2.10	0.51	0.51	1.10	
	5								1.40	0.90			0.85	
	6							1.50				(0.40)		
	7				1.20									
	10											(0.21)		
	bottom value	0.72		1.50	2.90		6.40	1.35	0.80	0.47	0.42	0.39	1.25	
	average value	0.69		1.71	1.73		5.75	1.62	1.26	1.16	0.46	0.38	1.06	

(cont.)

Table 6(h) (cont.)

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Edge Plume	1	0.63		0.95	0.79	0.77	5.00	1.50	1.22	2.10	0.40		0.42	
	5				0.90	0.90			0.87					
	6												0.52	
	8										0.36			
	bottom value	0.72		1.12	0.75	1.18	7.00	1.30	0.75	0.75	0.82		0.52	
	average value	0.68		1.03	0.81	0.95	6.00	1.40	0.95	1.43	0.53		0.49	
Lake	1	0.62	0.32	0.91	0.82		1.78	2.55	0.58	0.38	0.36		0.40	0.32
	5												0.32	0.31
	10		0.52		1.30				0.75					
	11												0.58	
	13		(0.52)											
	14							1.50			0.25			
	18				(1.15)									0.52
	25				1.68									
	bottom value	0.62	0.75	0.93	1.50		2.15	2.05	0.69	0.95	2.15		0.30	2.60
	average value	0.62	0.53	0.92	1.29		1.96	2.03	0.67	0.66	0.92		0.40	0.94

Table 6(i) Sulfate Values, ppm

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Power Plant	1	49		68	73		65	75	59	58	72		79	
	4										(71)			
	5			(72)										
	6												73	
	bottom value	69		71	73		69	76	56	68	70		65	
	average value	59		70	73		67	76	58	63	71		72	
Eng. Dock	1			69	68		68	78	60	72	71		79	
	3	66												
	5			68	73									
	bottom value			69	73								60	
	average value			69	71								70	
Middle Plume	1	40		36	22		34	41	31	34	33	28	48	
	5								28	25			37	
	6							35				(13)		
	7				22									
	10											(25)		
	bottom value	39		35	35		47	28	24	25	26	22	45	
	average value	40		36	26		41	35	28	28	30	22	43	

(cont.)

Table 6(i) (cont.)

		Fall 1968					Spring 1969			Summer 1969				
Station	Depth (m)	Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Edge	1	22		27	22	22	22	28	23	28	27		22	
Plume	5				22	22			23					
	6												22	
	8										25			
	bottom value	27		27	22	22	34	28	20	26	25		22	
	average value	25		27	22	22	28	28	22	27	26		22	
Lake	1	27	21	23	22		19	28	23	23	25		22	24
	5												24	23
	10		22		22				20					
	11												22	
	13		(22)											
	14							28			25			
	18				(22)									22
	25				22									
	bottom value	27	22	23	22		28	35	24	25	21		24	22
	average value	27	22	23	22		24	30	22	24	24		23	23

Table 6(j) Chloride Values, ppm

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Power Plant	1	32.5		40.0	45.0		32.5	35.0	22.5	22.5	35.0		45.0	
	~4										(37.5)			
	5			(40.0)										
	6												42.5	
	bottom value	50.0		40.0	47.5		37.5	25.0	22.5	30.0	30.0		40.0	
	average value	41.2		40.0	46.3		35.0	30.0	22.5	26.3	34.2		42.5	
Eng. Dock	1			42.5	45.0		40.0	30.0	25.0	35.0	35.0		47.5	
	3	45.0												
	5			42.5	47.5									
	bottom value			45.0	50.0								35.0	
	average value			43.3	47.5								41.5	
Middle Plume	1	20.0		20.0	10.0		20.0	17.5	12.5	15.0	15.0	15.0	27.5	
	5								12.5	12.5			27.5	
	6													
	7				12.5			12.5				(5.5)		
	10											(10.0)		
	bottom value	23.0		17.5	20.0		25.0	12.5	10.0	12.5	15.0	10.0	27.5	
	average value	21.5		18.7	14.2		22.5	14.2	11.6	13.3	15.0	10.1	27.5	

(cont.)

Table 6(j) (cont.)

Station	Depth (m)	Fall 1968 Sept. 15.5	Sept. (1)	Oct. 15.0	Nov. 10.0	Nov. (2) 10.0	Spring 1969 Mar. 12.5	Apr. 10.0	May 10.0	Summer 1969 June 15.0	July 12.5	July (1)	Aug. 7.5	Aug. (2)
Edge Plume	1													
	5				12.5	10.0			11.5					
	6												10.0	
	8										15.0			
	bottom value	15.0		15.0	12.5	12.5	20.0	10.0	10.0	10.0	10.0		10.0	
	average value	14.3		15.0	11.6	10.8	16.2	10.0	10.5	12.5	12.5		9.2	
Lake	1	15.0	10.0	10.0	10.0		7.5	12.5	10.0	10.0	10.0		10.0	10.0
	5												10.0	10.0
	10		7.5		10.0				10.0					
	11												10.0	
	13													
	14							15.0			10.0			
	18				(12.5)									10.0
	25				12.5									
	bottom value	15.0	10.0	10.0	15.0		15.0	15.0	10.0	7.5	10.0		10.0	10.0
	average value	15.0	9.2	10.0	12.0		11.3	14.2	10.0	8.8	10.0		10.0	10.0

Table 6(k) Turbidity Values, as ppm SiO_2 (Hellige Scale)

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Power Plant	1	20.9		15.0	10.8		5.9	12.5	12.9	17.9	9.6		13.0	
	4													
	5													
	6			(15.0)										
													14.5	
	bottom value			15.0	10.0		6.2	12.8	3.5	11.0	15.5		37.1	
	average value			15.0	10.4		6.05	12.65	8.2	14.45	12.55		21.53	
Eng. Dock	1			15.0	9.0			11.0	9.5	18.3	12.9		5.7	
	3													
	5			15.0	8.8									
	bottom value			15.0	9.5								22.5	
	average value			15.0	9.1								14.1	
Middle Plume	1	8.3		8.0	4.0		5.0	8.2	7.5	8.9	5.0	4.8	6.7	
	5								7.5	5.5			5.8	
	6							5.0				(4.2)		
	7				2.4									
	10											(3.7)		
	bottom value	8.3		8.0	4.8		4.0	5.0	7.0	3.9	4.3	2.1	9.3	
	average value	8.3		8.0	3.73		4.5	6.06	7.33	6.1	4.65	3.7	7.26	

(cont.)

Table 6(k) (cont.)

Station	Depth (m)	Fall 1968					Spring 1969			Summer 1969				
		Sept.	Sept.(1)	Oct.	Nov.	Nov.(2)	Mar.	Apr.	May	June	July	July(1)	Aug.	Aug.(2)
Edge Plume	1	4.3		5.2	1.9	2.5	4.0	3.8	8.5	5.8	4.4		4.0	
	5				2.6	2.5			3.3					
	6												5.3	
	8										3.4			
	bottom value	4.1		6.5	2.6	2.0	4.0	4.5	7.5	3.7	3.5		9.8	
	average value	4.2		5.85	2.36	2.33	4.0	4.15	6.43	4.75	3.76		6.36	
Lake	1	4.3	1.8	3.7	2.7		2.2	6.5	5.5	2.9	2.6		3.1	3.8
	5												4.0	5.0
	10		1.8		3.0				5.1					
	11												3.7	
	13		(2.8)											
	14							5.0			3.8			
	18				(3.0)								4.0	
	25				3.1									
	bottom value	4.3	2.9	2.0	3.9		2.5	5.1	7.5	4.1	5.7		3.9	3.0
	average value	4.3	2.32	2.85	3.14		2.35	5.53	6.03	3.5	4.0		3.67	3.95

Table 6(*l*) Water Temperature, °C

Station	Depth (m)	Fall 1968 Sept.	Sept. (1)	Oct.	Nov.	Nov. (2)	Spring 1969 Mar.	Apr.	May	June	July	Summer 1969 July (1)	Aug.	Aug. (2)
Power Plant	1	19.8		16.0	10.0		4.2	13.0	19.0	18.8	27.0		24.9	
	4										26.0			
	5													
	6													
	bottom												21.5	
	value	19.8		15.5	10.0		4.2	13.0	19.0	18.8	24.5		17.0	
Eng. Dock	1	19.9		16.0	10.0			13.0		18.7	27.0			
	3													
	5													
	bottom value	19.5		15.5	10.0									
Middle Plume	1	19.1		16.3	12.0		2.0	9.0	11.5	15.9	23.8	20.6	24.2	
	5								10.0	13.0*			23.0*	
	6							7.0*			15.0*	15.0*		
	7				12.0									
	10											12.0		
	bottom value	19.1		16.0	11.0		4.0	5.5	9.5	12.0	10.5	11.6	21.0	

(cont.)

* Within metalimnion.

Table 6(l) (cont.)

Station	Depth (m)	Fall 1968 Sept.	Sept. (1)	Oct.	Nov.	Nov. (2)	Spring 1969 Mar.	Apr.	May	June	Summer 1969 July	July (1)	Aug.	Aug. (2)
Edge Plume	1	18.8		16.9	12.0	12.0	2.0	4.5	10.5	15.4	22.6		23.2	
	5				11.6	11.5								
	6								9.5					
	8												21.0*	
	bottom										15.0*			
	value	18.8		16.8	10.2	10.0	2.5	4.9	8.9	11.2	12.0		20.0	
Lake	1	18.9	19.7	16.3	12.5		2.5	4.0	10.5	13.1	22.4			
	5												23.7	23.8
	10		19.2		12.0								23.7	23.4
	11								9.0					
	13		18.5*										22.5*	
	14													
	18							4.0			11.5*			
	25													15.0*
	bottom				11.9									
	value	18.5	15.0	16.1	11.5		3.0	4.5	8.0	11.2	6.0		18.5	7.5

Table 7 Physical and Chemical Results; Averages and Ranges in the Four Areas of Studies, Mouth of the Grand River, the River Discharge and Adjacent Waters of Lake Michigan, September 1968 to August 1969.

Station	PP			MP			EP			LAKE		
	mean	minim.	max.	mean	minim.	max.	mean	minim.	max.	mean	minim.	max
Surface water temperature, °C	16.9	4.2	27.0	15.4	2.0	24.2	13.8	2.0	23.2	15.2	2.5	23.8
Water temperature, °C, at sampling depths	16.6	4.2	27.0	13.4	2.0	24.2	12.8	2.0	23.2	13.7	2.5	23.8
Secchi disc (m) max. depth of visibility	0.8	0.5	1.3	2.05	1.3	4.5	3.12	2.0	5.0	4.5	2.5	7.5
Percent of surface light at disc depth	4.75	0.97	15.00	6.31	1.96	13.96	7.04	0.44	17.78	9.21	0.82	27.77
Dissolved O_2, ppm	7.7	4.0	12.0	9.1	5.0	12.0	9.4	6.0	13.0	9.5	6.0	12.0
CO_2, ppm	4.8	0.0	16.0	2.5	0.0	8.0	1.6	0.0	6.0	1.9	0.4	8.0
pH	8.74	8.50	8.95	8.73	8.42	8.92	8.71	8.45	8.90	8.65	7.65	8.90
Total Alkalinity as $CaCO_3$, ppm	203	165	240	135	110	170	120	100	160	117	100	150
NO_3-N, ppb	450	20	1200	170	10	480	150	10	290	149	0.0	490
NO_2-N, ppb	21.5	3.0	38.0	7.0	0.0	19.0	4.0	0.0	10.0	4.1	0.0	13.0
Ortho-PO_4, ppb	68.9	38.6	107.0	13.6	0.0	65.1	4.2	0.0	35.6	3.3	0.0	18.5
Silica, ppm	4.43	0.62	8.25	1.54	0.39	6.40	1.28	0.36	7.00	0.98	0.25	2.60
Sulfate, ppm	67.7	49.0	79.0	32.8	22.0	48.0	24.4	20.0	34.0	23.7	19.0	35.0
Chloride, ppm	35.5	22.5	50.0	16.9	10.0	27.5	12.0	7.5	20.0	10.8	7.5	15.0
Turbidity (SiO_2 ppm, on the Hellige scale)	12.8	3.5	37.1	5.9	2.1	9.3	4.3	1.9	9.8	3.8	1.8	7.5

Table 8 Dominant Diatoms and Major Algal Groups: Estimated Numbers of Units in One ml of Sample; Averages and Ranges, September 1968 to August 1969.

Station	PP			MP			EP			LAKE		
	mean	minim.	max.	mean	minim.	max.	mean	minim.	max.	mean	minim.	max.
Total Diatoms	7607	910	16941	3710	895	10093	2072	436	5754	1268	1	3801
Cyclotella comta (Ehr.) Kütz.	16	0	105	21	0	66	18	0	133	8	0	59
C. comensis Grun.	49	0	610	32	0	615	0.4	0	11	0	0	0
C. cryptica Reimann, Lewin & Guillard	29	0	433	15	0	266	0.4	0	6	0	0	0
C. kützingiana Thw.	16	0	110	19	0	129	21	0	104	9	0	72
C. meneghiniana Kütz.	269	0	889	77	0	477	14	0	113	7	0	94
C. meneghiniana v. *plana* Fricke	3322	281	8935	843	10	3439	236	9	1584	104	0	1395
C. michiganiana Skv.	9	0	55	33	0	237	31	0	112	19	0	158
C. ocellata Pant.	6	0	55	23	0	87	29	0	380	21	0	177
C. operculata (Agardh) Kütz.	1	0	29	24	0	154	21	0	348	8	0	129
C. pseudostelligera Hust.	0.8	0	9	7	0	154	2	0	32	0.8	0	20
C. stelligera (Cleve & Grun.) V.H.	34	0	237	43	0	377	41	0	475	12	0	112
C. striata (Kütz.) Grun.	7	0	101	0	0	0	0	0	0	0	0	0
Coscinodiscus subsalsa Juhl.-Dannf.	24	0	94	9	0	41	4	0	27	1	0	21
Coscinodiscus sp.	6	0	67	4	0	82	0.1	0	1	0	0	0

Table 8 (cont.)

Station	PP mean	PP minim.	PP max.	MP mean	MP minim.	MP max.	EP mean	EP minim.	EP max.	LAKE mean	LAKE minim.	LAKE max.
Melosira granulata (Ehr.) Ralfs	665	8	2259	419	5	2922	122	1	501	79	0	391
M. granulata v. *angustissima* O. Müll.	1206	9	3465	626	0	3378	250	2	1300	123	0	1261
M. granulata fo. *spiralis* Grun.	0	0	0	14	0	258	5	0	83	1	0	16
M. islandica O. Müll.	21	0	229	42	0	162	49	0	267	56	0	460
M. italica subsp. *subarctica* O. Müll.	0	0	0	12	0	66	22	0	140	13	0	156
M. varians Ag.	38	0	141	12	0	140	5	0	33	1	0	13
Stephanodiscus alpinus Hust. ex Huber-Pestalozzi	51	0	493	133	6	656	153	2	2116	94	0	836
S. astrea (Ehr.) Grun.	58	0	280	11	0	49	5	0	20	3	0	22
S. binderanus (Kütz.) Krieg.	0	0	0	50	0	593	30	0	262	7	0	72
S. hantzschii Grun.	341	0	3547	93	0	663	53	0	401	50	0	562
S. minutus Grun. ex. Cleve & Möll.	101	0	1297	30	0	155	23	0	188	20	0	237
S. subtilis (Van Goor) A.Cl.	324	7	1561	55	0	611	12	0	56	5	0	52
S. tenuis Hust. ex Huber-Pestalozzi	182	0	481	42	0	516	18	0	222	10	0	116
S. transilvanicus Pant.	0	0	0	30	0	284	51	0	903	49	0	517

Table 8 (cont.)

Station	PP			MP			EP			LAKE		
	mean	minim.	max.	mean	minim.	max.	mean	minim.	max.	mean	minim.	max.
Genus *Asterionella* Hass.	76	0	344	46	0	157	41	0.2	149	28	0	142
Genus *Diatoma* Bory	14	0	56	58	0.1	356	48	1	244	29	0	323
Genus *Fragilaria* Lyngb.	216	29	1246	400	70	897	441	3	1426	246	0	1149
F. capucina Desm.	7	0	20	100	0	426	95	0	386	53	0	285
F. crotonensis Kitt.	99	0	704	261	42	783	314	6	1034	172	0	839
Genus *Navicula* Bory	152	13	430	47	1	194	13	0.1	44	5	0	48
Genus *Nitzschia* Hass.	145	37	309	94	15	295	58	6	184	31	0	108
Genus *Synedra* Ehr.	104	3	289	100	4	276	62	2	322	68	0	351
Tabellaria fenestrata (Lyngb.) Kütz.	2	0	37	151	6	580	147	1	940	118	0	830
Total Greens	912	8	2356	559	14	4057	172	11	582	137	10	639
Total Blue-Greens	21	0	122	27	0	76	24	3	60	36	5	111
Total Chrysophyta	40	0	200	67	0	371	44	0	345	29	0	273
Total Pyrrophyta	40	0	312	37	0	373	12	0	63	8	0	69
Total Flagellates	449	100	1191	356	29	720	364	2	1092	192	0	608
TOTAL PHYTOPLANKTON	9073	1535	18939	4761	1439	14433	2692	944	6180	1682	421	4537

Table 9(a) Coefficients (β) of Selected Regression Equations.

Dependent variable (y): <u>Cyclotella meneghiniana v. plana</u>

Independent Variable (x)	Station PP	MP	EP	LAKE
Month	1552.3**	263.7**		
Depth				-27.9*
Relative Depth		905.6*	201.1*	404.4
Alkalinity		33.2*		11.9*
Chloride	-247.4**		91.3**	93.6**
CO_2				
Light		.187**	.117**	
NO_2-N		17717	19976	
NO_3-N		-3865.5**		-1314.7
O_2	710.2**			-79.9
pH				
Ortho-PO_4	40.27*	-39.64**		
Silica	-522.44**		-173.73**	
Sulfate		60.75	12.49	
Temperature		-113.43*		-11.53
Turbidity		234.57**		42.73
Time				
Constant α	-4792.57	-7020.69	-1307.51	-1256.33
R^2	.80	.88	.90	.61
F	10.85**	10.53**	28.53**	4.52**
No. of variables in the equation	5	10	6	8
d.f. for error	12	14	18	23

* Significance at 5 percent level; ** at 1 percent level.

Table 9(b) Coefficients (β) of Selected Regression Equations.

Dependent variable (y): *Melosira granulata* v. *angustissima*

Independent Variable (x)	Station PP	MP	EP	LAKE
Month	-477.5	1527.1*	1385.8	
Depth				-17.06
Relative Depth	-1371.03*	171.68		388.70
Alkalinity	15.97		10.95	8.75
Chloride	-146.64**			79.11**
CO_2				
Light	- .299*		.639*	.229
NO_2-N	115127*	27189		
NO_3-N	-4535.5*	-1958.7	3048.5	-2347*
O_2		436.64**	209.50*	-74.45
pH		-4511.15*	-838.13	-152.69
Ortho-PO_4	31.52*	-34.57**	-17.82	
Silica	-189.46	200.01	143.10	
Sulfate		92.78*	24.03	22.85
Temperature		-66.18	-43.56	-21.43
Turbidity	39.16	192.18	81.46	
Time	29.54	-85.17*	-74.63	
Constant α	3889.42	26995.60	-2457.46	331.95
R^2	.92	.87	.83	.64
F	7.75**	6.73**	4.87**	3.74**
No. of variables in the equation	11	12	12	10
d.f. for error	7	12	12	21

* Significance at 5 percent level; ** at 1 percent level.

Table 9(c) Coefficients (β) of Selected Regression Equations.

Dependent Variable (y): *Melosira granulata*

Independent Variable (x)	Station PP	MP	EP	LAKE
Month				223.9*
Depth		31.1*		
Relative Depth	-403.4			112.8*
Alkalinity	-6.10	9.27		
Chloride	-11.32	32.22		30.91**
CO_2	99.6**	126.34**		
Light				.863
NO_2-N	43936.1**	-36411.9		
NO_3-N	-2419.7**	-2236.5**	1079.9*	-1640.1**
O_2		-32.49		48.67
pH		1923.8	-132.6	6.16
Ortho-PO_4	17.39**	-23.31**		14.74*
Silica		329.94**		-61.27
Sulfate				2.94
Temperature			19.43**	-23.29**
Turbidity	11.6	124.32*		
Time		14.21*		-11.66*
Constant α	865.24	-19456.85	865.00	-1296.12
R^2	.84	.94	.42	.77
F	6.43 **	15.79**	5.07**	5.44**
No. of variables in the equation	8	12	3	12
d.f. for error	10	12	21	19

* Significance at 5 percent level; ** at 1 percent level.

Table 9(d) Coefficients (β) of Selected Regression Equations.

Dependent Variable (y): Bacillariophyta

Independent Variable (x)	Station PP	MP	EP	LAKE
Month	1811.6**	1114.9**	6607.5*	
Depth		145.3*		-44.09
Relative Depth				620.84
Alkalinity		40.8	-1.66	29.5**
Chloride	-710.4**	-35.8	153.3	301.8**
CO_2		559.54**		
Light	- .301		.400**	
NO_2-N	137467*			47224
NO_3-N		-10074.08*		-3518.97
O_2		793.9*	627.9*	
pH				
Ortho-PO_4	127.47**	-100.57**	-112.22*	
Silica	-1316.1**	2038.1**	1062.03*	
Sulfate	153.85		113.90	
Temperature			-452.27*	-116.50**
Turbidity		992.45**	379.86*	
Time			-373.36*	
Constant α	4212.75	-24387.26	-31523.86	-3348.96
R^2	.84	.82	.76	.80
F	8.55**	6.51**	3.88*	13.92**
No. of variables in the equation	7	10	11	7
d.f. for error	11	14	13	24

* Significance at 5 percent level; ** at 1 percent level.

Table 9(c) Coefficients (β) of Selected Regression Equations

Dependent Variable (y): Total algae

Independent Variable (x)	Station PP	MP	EP	LAKE
Month	2354	1616.1**	10551.7*	-71.8
Depth	4305	146.9	-98.6	-44.2
Relative Depth	-31661			636.9
Alkalinity	34.4	40.9	-8.6	21.4
Chloride	-677**			331.1**
CO_2	81.2	806.2**	-300.3	
Light	- .517	.121	.268	
NO_2-N	358152		14622	54022
NO_3-N	-9006	-13729**	-1608	-3550
O_2		475	1225*	
pH	25193	11001*		
Ortho-PO_4		-97.74**	-151.33*	
Silica	-1511.7*	2242.9**	1507.30	-239.93
Sulfate			260.5	
Temperature	-684.7*	-122.4	-716.1**	-119.7**
Turbidity		992.1**		
Time				
Constant α	-196294.10	-119515.58	-50523.26	-1527.81
R^2	.94	.94	.80	.82
F	8.02**	16.03**	2.99*	11.13**
No. of variables in the equation	12	12	14	9
d.f. for error	6	12	10	22

* Significance at 5 percent level; ** at 1 percent level.